THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LXIII.—No. 12. Whole No. 1,058. | NEW YORK, MONDAY, SEPTEMBER 16, 1895 | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Terms of Subscription, Including Postage—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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[OFFICIAL NOTICE.]

Twenty-third Annual Meeting, American Gas Light Association.

OFFICE OF THE SECRETARY, P. O. Box 1160,
PROVIDENCE, R. I., September 5th, 1895.

The 23d annual meeting of the American Gas Light Association will be held in the city of Philadelphia, Pa., on October 16th, 17th and 18th, 1895.

The sessions will be held at Association Hall, on Chestnut street. The following papers will be read:

"The Creation of a Healthy Public Sentiment Toward the Gas Company in the Locality in which it Operates," by Mr. W. H. Rogers, Paterson, N. J.

"Retort House Design and Practice," by Mr. A. E. Forstall, Newark, N. J.

"Notes on the Storage of Oil at Gas Works," by Mr. Frederic Egner, Norfolk, Va.

"The Ventilation of Gas Lighted Rooms," by Mr. Irvin Butterworth, Columbus, O.

"Bench Firing with Soft Coal," by Mr. E. G. Pratt, Des Moines, Ia.

One other paper was promised, but the serious illness of the author has delayed its preparation, so that it is now doubtful whether it can be prepared.

Reduced rates for transportation are being arranged for and undoubtedly will be secured. Further information will be given in a general circular which will soon be issued to all the members.

Applications for membership must be indorsed by two active members and be received by the Secretary on or before October 5th, as if received later than that they cannot be constitutionally acted upon at this next meeting. Write to the Secretary for blanks and full information.

Questions for the Question Box should be sent to the Secretary as early as possible, as each one will be referred to some member, who will lead discussion on it, and so it is very desirable that sufficient time be given for proper investigation of the subjects.

In a few days the Secretary will send out the annual due bills, and it is hoped that the members will make their remittances promptly, by check or postal money order, payable to the American Gas Light Association, and not leave the matter till the meeting, as the collection of dues at that time causes very much hard work for the Secretary, which could be to a large extent avoided if remittances were sent by mail.

The Committee of Arrangements are busily engaged in the preparations for the meeting, and further notice will be given as the details of the programme are finally decided upon.

Respectfully, A. B. SLATER, JR., Secretary.

BRIEFLY TOLD.

CONSOLIDATION AND STRENGTH.—This week we have positive evidence for belief in the saying that "in union there is strength," not that much testimony of the latter-day sort was required to show such was the case in former times, for gas men then usually respected each other's territory and were bound by their agreements. With the narrowing of dis-

tricts which might profitably be supplied came the desire of outsiders to share in the prosperity that such supplying afforded, and the outsiders, finding disgruntled insiders of the minority type ready to assist them, were not slow to avail themselves of the situation. The usual result of this co-operation was union on a certain basis, the terms whereof were, as a rule, dictated by the outsiders and their traitorous allies, and, under the final operation of which, we are pleased to say, the outsiders managed to get very much the better of the traitors. After a goodly season of this sort of proceeding—a season amounting almost to a score of years—the ordinary rules of common sense prevailed, and the "courageous" insider at last learned that that which he owned was at least as valuable to him as that which the outsiders did not own, and the result is at last, to the owners the property belongs. At any rate, we judge this to be the case from the developments of the day in respect of the effected consolidation of the gas interests of Newark, New Jersey, and in the virtually completed consolidation of the gas interests of Brooklyn, N. Y.; the first having been accomplished last week, while the latter is now merely a thing of detail, no matter what may be said to the contrary. Each of these transactions was completed in a spirit of perfect fairness to the shareholders, be they severally the owner of 1,000 shares or 1 share; for all shared alike in the division. It might be said, perhaps, that this verdict does not apply as fully to the Brooklyn situation as it does to the Newark one, but it must be remembered that although the assent of *every* shareholder in the Citizens and the Newark Gas Light Companies has been secured there for the merger agreement, the prices bid for the shares of the several holdings in the Brooklyn Companies has for months been well outside the intrinsic values of such shares, wherefore no shareholder in the latter can have ultimate cause for complaint. The real lesson taught by these two peaceful agreements is that purchasing instead of raiding is the rule of to-day; a rule that we hope and believe has come to stay.

THE BROOKLYN PREPARATORY MERGER AGREEMENT.—To make further mention of the consolidation in Brooklyn (the history of the Newark case has been given in our columns from time to time, and a continuation of that mention will be found on pages 456-457 of our number for to-day) it might be in order to say that the projectors of the movement have gone ahead, to the point of filing articles of incorporation which certify that the name of the concern is to be the Brooklyn Union Gas Company, and that its named Directors are: George M. Young, Grant B. Schley, John L. Mills, Hamilton H. Durand, W. B. Dickerman, Chas. E. Ball and George R. Turnbull. While the named men are all prominent in local financial circles, we think we are close to the mark in saying that when the final adjustment of interest is made others will appear as the representatives of the properties involved. The statement is that the capital stock of the Company will be $15,000,000, and we may supplement this by noting that a bond issue in equal amount will follow—a combined money representation not at all in excess of the earning powers of the separate Companies concerned in the agreement. It is said by those who are conversant with the situation that when the smoke of the organization battle has cleared, General James Jourdan, of the Fulton-Municipal Company, will be found in command, with Colonel Fred. S. Benson as the Engineer-in-Chief—pretty good selections, we are obliged to confess.

NOTES.—Captain Burr, of the water and light department of Washington, D. C., in his annual report sensibly remarks the hours for public lighting there are all too short. He recommends that 3,800 hours should be named to replace the prevailing schedule of 3,000, and we recommend that he and they stretch the schedule to 4,000 hours.——An explosion wrecked the holder of the Fond du Lac (Wis.) Company. The damage is put at $6,000, but the resultant benefit to the Company through its construction of a new holder ought to be worth twice the present nominal loss.——The Elizabeth (N. J.) Company will not extend its mains to Westfield this fall, because the sewer contractors are at work in that vicinity.——President Gawtry, of the Consolidated Company, of this city, is back from his trip to Europe, a new man, we are more than glad to say.——The new car barn for the Hartford Street Railway Company, of Hartford, Conn., will be designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn. The office will be located in the front end of the building on State street, with the barn in the rear. The whole construction is to be of steel, and fireproof, the roof being covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roof covering.——The situation at Syracuse, N. Y., is still in a very unsettled condition, the would-be purchasers seeming to hold that the owners of the existing Company ask too high a price for their property. Meanwhile the old Company is going right ahead making and selling gas.

The Heating Value of Coal Gas.

[A paper read by Mr. David Vass, of Portobello, before the North British Association of Gas Managers.]

Coal gas is now used so extensively for other purposes than lighting that I think I may make bold to remark that a test of the luminosity by photometry does not sufficiently deal with the product of which we are sellers, and to suggest for adoption, conjointly with or in substitution of the photometric standard, a standard of comparison having a more direct relation to the calorific value of the gas, instead of remaining content with the vague assumption that the heating value of a gas varies with the illuminating power. When the question of "High versus Low Candle Power Gas" is discussed, it is invariably suggested that we are sellers of light, and not merely sellers of gas. I prefer to support the idea that we are sellers of energy in the form of gas. We may look upon coal gas as a convenient form of heat energy, ready to be utilized, primarily for lighting purposes by direct combustion, or indirectly by incandescent lighting; secondly, for domestic purposes in cooking and heating stoves; and, thirdly, for commercial purposes in reproducing energy by means of the gas engine. Undoubtedly our oldest friend—lighting by direct combustion—is still our best friend, but the others have assumed such importance that they demand some consideration at our hands.

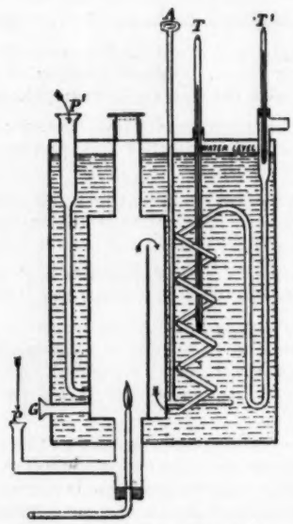


Figure 1.—The Dulong Calorimeter.

In testing the heating value of combustible substances the most convenient method is to transmit the heat to a measured volume of water, and I will describe some instruments specially designed for this purpose. Dulong's calorimeter (Fig. 1) is an instrument designed for examining the amount of heat evolved during the combustion of solids, liquids or gases. It is a simple apparatus, and one which only requires very slight modification to suit our purpose. It consists of a combustion chamber surrounded by water contained in a calorimeter, wherein moves an agitator, the stem of which is seen at *A*. The gas is conducted into the chamber through the tube, and the oxygen necessary for combustion enters by one of the tubes or *P P*¹. The products of combustion pass through the worm, and finally escape, but not until they have fallen to the temperature of the water in the calorimeter. Two thermometers, *T T*¹, are fixed—one to indicate the temperature of the water and the other that of the products of combustion at their exit. For accurate work these two thermometer readings should agree. The progress of combustion is observed through the opening *G*, which is closed by a piece of glass. The water in the calorimeter is a measured quantity, and its rise in temperature for a given volume of gas burned is taken as the datum for the results.

Taking this instrument as a basis, I designed one (Fig. 2) in which the worm encircles the combustion chamber instead of occupying one side of the cooling vessel. This alteration was made with two ends in view: (1) To economize space, so as to have a more convenient form of instrument, and (2) to equalize the temperature of the water throughout the calorimeter without the aid of the agitator. On the second point I have not been altogether successful. The heat of the flame striking the top of the combustion chamber causes more rapid heating of the overlying water at that point than at the lower depths of the calorimeter,

but this I hope to overcome by introducing a bell to carry the products of combustion to the bottom of the combustion chamber before they come into direct contact with the heat absorbing surface. The combustion chamber is made of copper, and there is a partition of tin plate

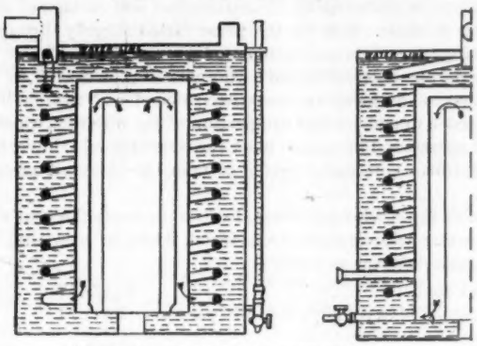


Figure 2.—Modified Calorimeter, with Worm.

to cause the products of combustion to travel to the lower level of the combustion chamber and there to enter the worms. Some difficulty was experienced in winding copper tubing sufficient in cross section to carry off the products of combustion, and for this reason two worms were used, their outlets being connected.

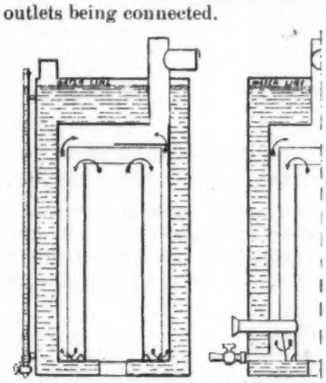


Figure 3.—Modified Calorimeter, without Worm.

In the arrangement shown in Fig. 3 no worm is used. The gases pass downwards between the tin plate partitions and come in contact with the cooling surface at the bottom; then, travelling upwards between the tin plate partition and the cooling surface, they pass out at the top.

I have related some of the difficulties in construction and points to be avoided for the benefit of any one experimenting on the same lines.

An instrument known as the "Junker's Patent Calorimeter" has recently been placed on the English market, and so far as I can ascertain, it is the only calorimeter in the market adapted for testing gases. In this instrument the products of combustion pass downwards from the top of the combustion chamber through two rows of tubes, which are surrounded by water. A constant stream enters at the bottom of the annular water space, and, passing upwards, is heated by the tubes already mentioned and by contact with the sides of the combustion chamber. The rate of flow and the increase in temperature of the water are noted, and the multiple of these is the calorific value of the heat imparted to the water by the quantity of gas consumed.

There is very little difference in principle between Dulong's and Junkers' calorimeters; but one great drawback to the general adoption of the latter is the cost ($117.50). I am confident that an instrument as substantial and satisfactory, but less elaborate in finish, which could be put on the market at less than half the present price, would come in for more general use, instead of being kept for ornament as a highly-finished, high-priced instrument is apt to be.

The general adoption of any form of instrument would turn attention towards the perfecting of an appliance to be adopted as a standard; and such an instrument should be simple, reliable, substantial and not too costly in finish.

Discussion.

Mr. J. M'Gilchrist (Dumbarton) said it would be most interesting to hear Mr. Vass's experience of the heating powers of different qualities of gases. He understood that the instrument Mr. Vass had designed was correct in its working.

Mr. Vass said it was with the view of ascertaining if there was a relation between the heating value and the lighting value of a gas that he began some time ago to make inquiries into the subject, and his first difficulty was to get an instrument suitable for the purpose. At that time he had not seen the Junkers calorimeter. It was only advertised about November last (but at a price which, he thought, would not be acceptable to most gas managers); and he formed the idea that he would like to make an experiment. He had found difficulties with instruments, some of which he had pointed out, and the reason he had mentioned those difficulties was that other investigators working on the same lines might know them. One difficulty was the winding of the tubes, and the other was the heating of the water at the top, owing to the flame striking at that place. Alterations on account of this had delayed the making of any experiments sufficiently satisfactory to place before the meeting, and he would prefer to have time in which to experiment with the apparatus before he could suggest anything to the members. His present communication was intended more to "draw" gas managers as to whether or not they thought it advisable that they should have a calorific test in every gas works. He thought they should, but one drawback with him had been the expense involved.

Mr. T. D. Hall (Montrose) thought they could not but thank Mr. Vass for the paper he had just read. There was something novel in the idea of being able to tell a consumer the value of his gas for heating purposes. Most of them had consumers who did not use gas for heating or motive power, and they were occasionally asked by them the value of their gas for these purposes. Sometimes consumers would quote the illuminating power, and ask with regard to their gas which they made of higher illuminating power than their neighbors, and consequently dearer, if they would not be better with a gas of lower lighting power, and he thought that if they had an instrument like that described, they would be able to answer the question. They were assured by gas engine and stove makers that they had quite as good results from gas of low illuminating power as they did from the rich gas which they had in the North. If Mr. Vass could perfect his calorimeter he would put an instrument into their hands which, as gas managers, they would find extremely useful.

Mr. A. McPherson (Kirkcaldy) said it should not go forth to the world that they could get the same results from a low-quality as from a high-quality gas. He thought Mr. Young had made it very plain that morning that, if they had a high-quality gas, they would get an equally high value, however they used it, whether for heating or for motive power purposes. There was no doubt that in the illuminating power the carbon was what controlled the light, and it was the same with the heat and motive power.

Mr. A. Yuill (Alloa) also considered that the remarks of Mr. Hall should not go forth. He held in his hand a report from one of the largest gas engine makers of the day. He put to him the question as to what was the difference between 16 and 30-candle gas, and the reply was that the percentage of 16 candle gas was 11 and the air volume 89. If they were dealing with 20-candle gas, the percentage of gas was 9.5 and the air volume 90.5. If they were dealing with 30-candle gas, the gas fell to 7 per cent. and the air volume was 93 per cent. This clearly showed that the richer the gas the less they required for motive power. When they came to Dowson gas, they required 44 per cent. of gas and 56 per cent. of air. This was going the other way, and it very clearly demonstrated, he thought, that the richer the gas the less they required of it.

Mr. D. M. Nelson (Glasgow) said the question before them was one which had been often raised—whether the blue or the white flame (meaning low or high quality gas) did the most cooking. He was in a position to state, with reference to two stoves, identical in all respects except that to the one 20 and to the other 26-candle gas was supplied, that a joint was cooked by the 26-candle gas in a third of the time in which one was cooked by the 20-candle gas. He was satisfied of this, that the calorific power of rich gas was greater than that of low-quality gas, notwithstanding the authorities to the contrary. With a high-quality gas they did cooking in less time than with low-quality gas, and with a corresponding saving of gas.

Mr. J. Hepworth (Edinburgh) remarked that though these observations were taking them rather off the line, they were perhaps useful. He did not think anyone wouuld dispute that high-quality gas had a high calorific power; but in the Southern part of the Kingdom they had gone further, and said: "Yes, but which is the cheaper to use?" This brought them back again to the paper. He thought if they had an instrument like the one described, and observations could be made regularly with it, it would be useful to the manager of a gas works in enabling him to know what was the calorific value of the article he

was selling as well as he knew the illuminating power. He wished Mr. Vass had been able to give them some illustrations as to what he had found in ascertaining the thermal value of gas. This would follow afterwards of course; but as a matter of fact, if they had the power to make the tests alluded to, it would be of great advantage to them, by enabling them to see what was the value of their gas, now that it was so largely used for heating purposes.

Mr. Hall said he would just like to mention that, while admitting that from a rich gas they would get possibly better results than from a poor one, they at the same time all knew that the richer the gas the more difficult it was to develop heat, and the question of price had also to be looked at. Where gas was only employed for heating and motive power he still said it was a question whether it was not very much cheaper to use gas of low illuminating value for this purpose than a rich kind which it was difficult to develop, not only in stoves, but also in gas engines.

Mr. MacPherson said he must entirely differ from Mr. Hall in this matter. There was not the slightest doubt that this was the old bogie raised. They were told they could not burn 28-candle gas. But they all knew this to be downright "bunkum," for they could burn any quality of gas. It was said that they could not reduce the carbon—that there was a greater difficulty in getting the full value from the carbon in a high quality than in a low quality gas. Well, there was as much difficulty, and more, in admitting too much air to the low quality gas, and thereby cooling the flame. If they had a little too much air, in the case of the rich gas, they did not suffer so much as they did in the case of the poor gas, because they reduced to a greater extent the heating power of the low quality gas by the admixture of too much air.

Mr. Hall thought everybody who had had any experience of using the two qualities of gas would admit that they had less trouble with the low quality, both in lighting and heating. As gas managers, they knew very well how to burn any gas; but the difficulty was to educate their consumers.

Mr. MacPherson said the apparatus could be made suitable. They knew that a gas fire made for English gas would not burn Scotch gas; but they had makers who could produce stoves to suit each. It was the same with gas engines. The matter was regulated for them, and the consumer was only called upon to turn the tap.

The President said the discussion had wandered into a sort of side issue; but he thought this only showed the necessity for having an instrument such as the one described, by which to measure the heat. He could only say he hoped Mr. Vass would be encouraged to go on with his inquiries.

Mr. Vass said it was a complaint from a consumer who used a cooking stove, that there was not sufficient pressure to do the cooking, which put him upon his inquiry. He had been using an inferior coal, and he set himself to ascertain whether there was really so much difference in the heating power of a low quality gas as to cause such inconvenience. It was not with the view of putting forward any special system that he took up the subject; but rather with the idea that gas managers might be induced to turn their attention to experiments in that direction. One man could not arrive, in the little time he had at his disposal, at what would be the best and cheapest thing for the trade. He wished to get others to look at the question, and perhaps something more might be arrived at.

Gas Making from Splint and Shale, and from Splint and Oil.

[A paper read by Mr. A. Waddell, of Broughty Ferry, before the North British Association of Gas Managers.]

For the past year or two, the subject of the enrichment of coal gas by means of oil has been receiving a considerable amount of attention. At our two previous meetings, the application of the Peebles process to that purpose was prominently brought under our notice; and at the "Informal Meeting of Gas Managers," held in Glasgow during the spring of the present year, the subject received a good deal of attention. Having had some little experience in the use of oil as an enriching agent, it occurred to me that I might contribute a paper giving the plain and unvarnished practical results we have obtained at Broughty Ferry during the year ended May 31, 1895, stating under what circumstances and conditions they were realized, with deductions therefrom; and I hope they may be useful to anyone who may wish to consider the advantages and disadvantages of the several systems of working, viz.:

(1) The carbonizing of shale and splint coal, in settings of four retorts by direct fires;
(2) In settings of six retorts on the regenerative principle; and,
(3) Carbonizing splint coal in the latter settings, and oil by the Peebles process.

Prior to the introduction of this oil process we used splint coal and shale, because we had best value offered to us in these materials, owing to local circumstances.

I have given the cost of gas making materials stored in our works, only adding the extra outlay for purification and cartage of refuse due to the use of shale. But as the price varied largely throughout the year, owing to the late coal strike, and as most of the dear coal was used during one section of the year's working, it would be unfair to that section to charge all the increased price of coal against it. Therefore, in order to make a fair comparison of the different ways of working, it is necessary to estimate what the results would have been with coal at uniform cost, and I prefer to take our contract price for this purpose.

To enable those who may desire to do so to verify the year's results, I have here our balance sheet, from which it can be seen that the total cost for materials was as under—

Gas coal	$8,871.12	
Gas oil, *plus* royalty, at $13.75 per ton	2,211.79	
	$11,082.91	
Less residuals	5,375.97	
		$5,706.94
To this $5,706.97 there falls to be added—		
Extra cost of purifying	$266.93	
Trimming of coals	170.93	
Cartage of odd quantities of coal	123.31	
Cartage of shale refuse	55.87	
Excess of coals over invoice weight	50.50	
		$667.54
Making with the		5,706.94
A total of		$6,374.38

Gas made during the year 1894-5, 33,692,000 cubic feet.
Average illuminating power for the year, 26.02 candles.

These figures, so far as this paper is concerned, are all important. They are the sum of the three tables "A," "B" and "C," which follow, are half the subject matter, and must form the basis of most particulars hereafter given. According to them, the cost of gas for the year was—

Per 1,000 candles	3.42 cents.
Per 1,000 cubic feet of 25-candle gas	17.12 "

With coal at our contract price, the cost would have been—

Per 1,000 candles	2.94 cents.
Per 1,000 cubic feet of 25-candle gas	14.72 "

The materials given in Table A were carbonized from June 1 to August 9 last year in settings of four retorts by direct firing, and the bench was in good order. The retorts and settings being renewed annually, is evidence that nothing was spared to keep this plant in good condition.

Table A.

	Tons.	Cwt.	Rate per Ton.			
Splint coal	153	14	$2.48	=	$382.16	$831.62
Shale	117	5	3.83	=	449.46	
Cartage of shale refuse, 70¼ tons, at 16 cents						11.70
Extra cost of purification incurred on account of excess of impurities in shale = 2.66 cents per 1,000 cubic feet						62.18
						$905.50
Less residual products, coke *nil*, tar and ammoniacal liquor, at 79 cents per ton of coal carbonized						192.72
						$712.78
Less, calculating splint coal at $2.29 per ton (the contract price), a difference of						38.08
						$674.70

Gas made from above material	2,269,500 cubic feet.
Average illuminating power	25.81 candles.
Cost per 1,000 cubic feet	30.14 cents.
Cost per 1,000 candles	5.84 "

Taking the above splints at $2.29 per ton (the contract price), the cost would be—

Per 1,000 cubic feet of 25-candle gas	26.16 cents.
Per 1,000 candles	5.52 "

It will be noticed no coke was sold while using this setting, and considering the proportion of shale carbonized, etc., the result is not unusual.

The materials given in Table B were carbonized in a good regenerative setting from August 9 to November 5.

TABLE B.

	Tons.	Cwt.	Rate per Ton.		
Splint coal	411	13	$3.46 =	$1,427.83	$2,655.00
Shale	320	0	3.83 =	1,227.17	
Cartage of shale refuse					32.00
Extra cost of purifying incurred on account of excessive impurities in shale					204.75
					$2,891.75
Less residuals—					
Coke				$274.67	
Tar and liquor, at 79 cents per ton of coal carbonized				578.18	
					852.85
					$2,038.90
Less, calculating splint coal at $2.29 per ton (the contract price), a difference of					484.45
					$1,554.45

Gas made from above materials..... 7,303,500 cubic feet.
Average illuminating power..... 25 candles.
Cost per 1,000 cubic feet..... 26.80 cents.
Cost per 1,000 candles..... 5.38 "

Taking the above splint coal at $2.29 per ton (the contract price), the cost would be—

Per 1,000 cubic feet of 25-candle gas..... 20.50 cents.
Per 1,000 candles..... 4.10 "

It will be noticed that in Table B we had a saving of $274.67 in coke sold, though the proportions of splint and shale were similar to those used in the direct-heated retorts.

The materials given in Table C were carbonized in oil gas retorts from November 5, 1894, to May 31, 1895.

TABLE C.

	Tons.	Cwt.	Rate per Ton.		
Splint coal	2,267	13	$2.45 =	$5,580.08	
Shale	40	13	3.82½ =	155.75	
Oil, *plus* royalty, at $13.75 per ton				2,211.79	$7,947.62
Cartage of shale refuse					5.08
					$7,952.70
Less residuals—					
Coke				$2,342.50	
Tar and liquor, at 79 cents per ton of coal carbonized				1,827.39	
Oil coke				160.00	
					4,329.89
					$3,622.81
Less, calculating splint coal at $2.29 per ton (the contract price), a difference of					$377.96
					$3,244.85

Gas made from above material..... 24,119,000 cubic feet.
Average illuminating power..... 26.79 candles.
Cost per 1,000 cubic feet..... 14.20 cents.
Cost per 1,000 candles..... 2.66 "

Taking the above splint at $2.29 per ton (the contract price), the cost would be—

Per 1,000 cubic feet of 25-candle gas..... 11.90 cents.
Per 1,000 candles..... 2.38 "

It is interesting to notice the gross and net cost of materials with the residuals sold by the various ways of working, as under—

Materials.	Splint and Shale in Old Settings. A.		Splint and Shale in Regenerative Settings. B.		Splint and Oil by the Peebles Process. C.	
	Actual.	Allowing Contract Price for Coal, at $2.29 per Ton.	Actual.	Allowing Contract Price for Coal at $2.29 per Ton.	Actual.	Allowing Contract Price for Coal at $2.29 per Ton.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Gross cost per 1,000 candles	7.40	.....	7.64	.....	5.84	.....
Residuals sold per 1,000 candles	1.56	.....	2.24	.....	3.18	.....
Net cost per 1,000 candles	5.84	5.52	5.38	4.10	2.66	2.38
Cost per 1,000 cu. ft. of 25-candle gas	29.00	27.60	26.80	20.50	13.20	11.90

At the last informal meeting of Scottish Gas Mangers, when we had been working with the Peebles process for a very short period, and having (as time has now proved) just passed our initial difficulties, caused by starting the plant before it was quite complete, I then believed, and stated, that we expected to save about 2 cents per 1,000 cubic feet. I am pleased to-day to admit that I was then wrong. Comparing it with the results of the regenerative working, we save 8.60 cents per 1,000 cubic feet of 25-candle gas; and with the direct heated retorts, 15.70 cents. This, with other improvements, has enabled us to reduce the price of gas 20 cents per 1,000 cubic feet.

Since the introduction of the process, its simplicity has been recognized by all. We can fully confirm this. When working with two men on each shift, one man had charge of the oil and the other the coal retorts; and when the second man went off, the coal retort man had no difficulty in working both coal and oil retorts. At first the men were rather averse to working the oil gas retorts, but now they are all anxious to have that work.

When the stock of gas falls low, we find it a great advantage (by simply running more oil into the retorts) to get the lighting power largely increased, thereby giving our consumers sufficient light, if not volume, until we have gained our normal position.

It has been pointed out by others that it depends largely on circumstances what advantages will follow the adoption of this process. In our case, we can secure at a fair cost splint or coking coal, which gives us an excellent coke, for which we have a good market. We receive the same for the tar and liquor from this coal as we did from expensive coals, leaving us a low net cost for material. The Peebles process enables us to use a large quantity of this cheap coal, and the oil is at the same time by far the cheapest enriching system we can secure.

The plant is now well known to you all. It is simple and easily worked, save for one thing—viz., the tendency of the retorts to crack; and this, I understand, is being gradually overcome. We must all agree that, to keep a cast iron cylinder red hot from without, thereby expanding it, and then to keep flowing along a line of its inner surface, in direct contact with it, a continually cold stream of oil, thereby contracting only that particular part, is surely a severe strain on the iron, and must tend to crack it. To save it from cracking, you must keep the retort, particularly along this line, as near the temperature of the body of the retort as possible, by removing all obstructions in the form of thick brick walls, or any wall at that part. I understand that, instead of a loose steel plate, there has been substituted at some gas works a steel plate or false bottom to the retorts, held in position by fillets cast on the sides of the retorts. This has given very satisfactory results.

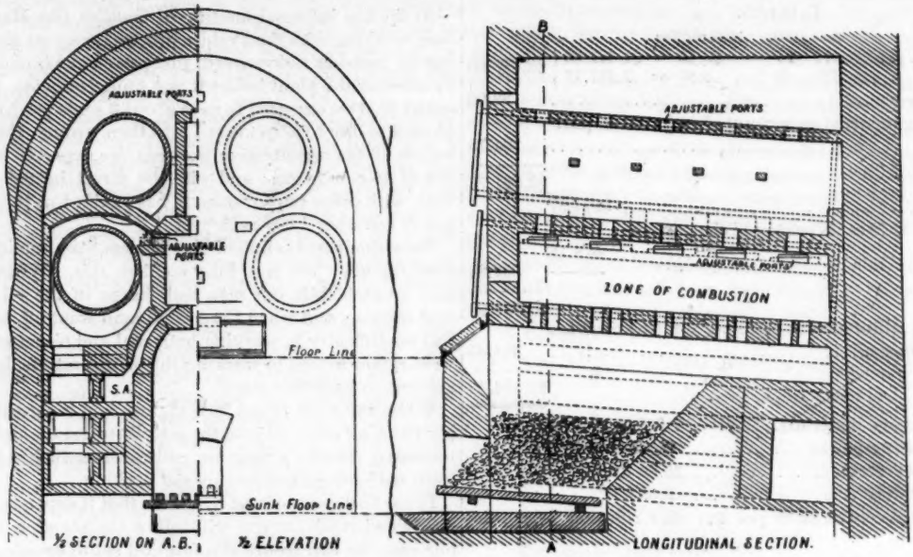
As uniform heating is necessary in coal gas retort settings, there has been special reason for saying this in connection with oil gas retort settings. We have worked our retorts at Broughty Ferry for more than seven months without the least sign of cracking or unevenness of any kind, the retorts looking as if they would last for four or five years. This means a very great saving in money and anxiety on the part of the manager fearing that the retorts may give way just when they are most needed without others to fall back on.

I have here diagrams of our regenerative oil gas retort setting designed and worked by me continuously for the past seven years, constructed on the following lines: (1) Large furnace bar area, large producer, combustion chamber, and flue capacity; hence slow travel of gases. (2) The least possible amount of brickwork about the retorts consistent with efficiency, and placed to give uniformity of support—all as thin walls not exceeding 4½ inches thick, with frequent openings immediately around the retorts. (3) Simplicity of construction, and hence economy, with greatest facility to see the interior. (4) The zone of combustion of gases parallel to the retorts, and extending from front to back of the oven; the resultant gases afterwards travelling at right angles to the zone without a turn, save at the arch and wall of the oven direct, until underneath the bottom retorts.

Discussion.

Mr. J. M'Gilchrist (Dumbarton) asked Mr. Waddell if he had saved 14 cents per 1,000 cubic feet by the introduction of oil—that was, comparing the charges with those of the previous year, when he was working with shale.

Mr. Waddell said the way he had given the facts was this: In the previous year he was working with shale and splint coal; and he put the cost of the materials used in the previous year against the cost of those used in the year just closed. It might be said that, to some extent, it was in the buying of the coal, or that it was in better working; but he



Oil Setting (Peebles Process) at the Broughty Ferry Gas Works.

could admit that they had their material for gas making for 15.70 cents less than in the previous year.

Mr. A. MacPherson (Kirkcaldy) asked if they paid the same price for splint coal, or if there had been any fall in the value of coal used.

Mr. Waddell said it was pretty much the same.

Mr. MacPherson asked if Mr. Waddell obtained the same for residuals in the two years. He would possibly get about double for tar and liquor in one year than he did in the other.

Mr. Waddell said that was quite true; the figures were 46 cents, as against 79 cents.

Mr. A. Yuill (Alloa) felt it very refreshing to get one standing up and advocating the process which he himself had been advocating all along. At the spring meeting of gas managers in Glasgow he had to bear a severe castigation; but Mr. Waddell was, perhaps, better able to meet them. The position, so far as he understood Mr. Waddell, was this: He gave his working before the introduction of the oil process, and at the price of coal before the miners' strike. The cost of this appeared to be 30.14 cents per 1,000 cubic feet. In Table B, giving the contract prices of coal, the cost was 26.08 cents per 1,000 cubic feet; and the net cost for splint coal, shale and oil was 14.02 cents. Then they found, compared with the results of regenerative working, a saving of 8.06 cents per 1,000 cubic feet. He understood Mr. Waddell to say that there was a saving of about 8 cents per 1,000 cubic feet by the introduction of the oil process; the difference between that cost and the full saving being attributable to the full saving effected by the regenerative system of heating the retorts.

Mr. MacPherson—And the increased price of tar and liquor.

Mr. Yuill said, naturally, they all had the benefit of that. There was another fact which might, perhaps, bear with Mr. Waddell, which was the large proportion of coke he had to dispose of. He understood that the price Mr. Waddell received for coke was very much in excess of what they generally obtained. He was glad to find that the costs given were very much the same as his own costs. In taking the coal, oil and royalty, less residuals, for the full year's working, the cost equalled 14.96 cents per 1,000 cubic feet; but deducting the sum paid owing to the miners' strike—which came to, on the average of the whole year's working, 0.86 cent—there would be left a net cost, on the contract prices, of 14.10 cents per 1,000 cubic feet. It was no use his going into the estimates for this year. He might, however, say that they were considerably less than what their past year's working had been. But there was one thing he might mention. In these figures, they had had presented to them as an Association the actual cost of the oil process for the past year or two, and it might assist in the discussion of questions like this if they had the actual costs to produce the same illuminating power of gas, or near it, placed alongside, so that they might see how they stood in the meantime. They sometimes imagined that they were doing better than other people; but if they kept their eyes open, they might see differently. It might be better if someone had the courage to give them the figures he obtained in the working of coal and shale.

Mr. MacPherson said that, without deducting residuals, he thought it did not cost him so much. He supposed he did not get as good a return for residuals; but, on the whole, he believed he was making coal gas of equal quality as cheap as Mr. Yuill. While he admired the Peebles system, and must allow that it was a most unique process, and one which he believed was bound to make way, there were a great number of things to be considered. For instance, Mr. Yuill said that Mr. Waddell obtained a very fine price for coke. He did not know what the price was per ton.

Mr. Waddell—I get $2.75 per ton.

Mr. MacPherson said most of them would consider themselves very happy with something like half of that figure. For his own part, if he had the same amount of coke thrown upon his hands as he would have if he were to go in for carbonizing only splint coal and using oil for enriching, he supposed he would not get more than 62 cents for it. There was no demand for coke; and therefore, as he had said, the benefit of the process was all according to the circumstances of the district. Everyone must consider the subject according to the circumstances in which he was placed; and in his own case he considered that, if he were to adopt oil enrichment, it would entail upon him a very serious loss. He did not say but that, in some places, it might be a very considerable gain.

Mr. Yuill said he had put the question to Mr. MacPherson if they could get the figures which his gas cost; but all his answer was: "I am doing better than you."

Mr. MacPherson said that if Mr. Waddell obtained $2.75 per ton of coke, and he could only get half of that, how could he give figures? He could only say he was doing well.

Mr. Yuill said that what he asked for was the net cost of the gas—the plain facts; and they would be able to judge for themselves.

Mr. MacPherson said it simply resolved itself into the old position, that it was a question of circumstances. It was impossible for him to compare what he would do with oil, as against what Mr. Yuill or Mr. Waddell would do, when he told them honestly that he could not get 62 cents per ton for the coke which would be thrown on his hands. He had to use a non-coking coal largely, so as to get it disposed of.

Mr. J. Hall (St. Andrews) said he had not intended to have said anything in the discussion, but he must own that he was very much taken with what Mr. MacPherson had said—that the circumstances of each gas undertaking must rule their preference for splint or oil enrichment. At least to him it was very strongly put. His Directors were most anxious that he should follow suit with those who had adopted the oil process. They had heard about it, and read the statements made by Mr. Yuill and others about it, and were thinking that they in St. Andrews were not doing what they ought to do. Their place was very small, and it was surrounded on every side by government property, so that they were obliged to make the most of every corner they had. However, he did contrive to say to his Directors: "Here is a corner in which I can erect apparatus for oil, if you wish me to do it; but I do not think it will be an advantage to you." Their retort house was very small; and he was obliged just now to work shale, and cannel, and splint. He did not see how he could extend the retort house—at least very much; and he found, were he to work splint coal only, and use the oil process,

that he would have as many retorts working as at present, and he would not make nearly the same quantity of gas. Another thing was that they would not get their coke sold. Their locality was small. They had a demand for coke just now, but at certain seasons of the year they were obliged to sell it at a very low price. They were nearly three-quarters of a mile from a railway station, and cartage cost them nearly 25c. per ton. Then, also, they had to add the reduction in the price they obtained for their tar. Upon the whole, therefore, from what he had heard from some of his younger friends who had adopted the oil process, they had had considerable trouble, and had great doubts whether they were better off than they were before. He had had a talk with one who had been working the oil process all last year, and he had had considerable complaint from his consumers. Of course, that was owing to the burners; but he was no better than he was in the year previous. He thought that, in a locality where they were at a considerable distance from a railway, if they could sell gas of from 25 to 26-candle power at 87c. per 1,000 cubic feet, they were not doing very badly. Broughty Ferry was a near neighbor, and he was naturally a little anxious at living near a gas manager who was doing so well. He thought the paper, in some respects, was not just a fair contrast between the two years—working with a change of retorts. Mr. Waddell entered lately into these works, and had made many changes upon them; and the comparison did not seem. to his mind, just so fair as he considered it might be. However, he thought they might give Mr. Waddell credit for what he had done. But his main object in speaking was to confirm what Mr. MacPherson had said—that the circumstances of each case must rule their action. He could not see it otherwise.

Mr. A. Bell (Dalkeith) said that Mr. Waddell's paper was full of figures, and would require some time to look over. He himself had had no difficulty with the oil process, and they had been working it for two years. Some people, apparently, said they had had difficulty, but he had had none—not even a burnt hand in the works. It had been nothing but plain sailing all along. With regard to cracked retorts, he had them badly cracked last year, by careless working. This year he had rolled them round, and they would now serve him another season. Mr. Waddell said he believed that the steel plates would be a very great saving. They had been using a steel plate in Peebles, and probably they would get a report regarding what had been done there. His retorts, unfortunately, had deep mouthpieces, and he could not use a fixed sole plate. But he used plates which were lifted out and in at each charge. As regarded coke, in this matter they could force a sale. When he went to Dalkeith he could scarcely get into the yard for coke, but he set himself to sell it. He showed the advantage, to bakers and others, of changing their fires from coal to coke, and he had now no difficulty in selling his coke. In fact, last year he had to send to Edinburgh for coke to supply the local people. Of course, everyone must speak for his own circumstances; but he thought if Mr. MacPherson would consent to enlighten them as to his figures, they would be able to make a better comparison.

Mr. T. Douglas Hall (Montrose) said he could not go into the figures, but he would like to go outside the works, and ask Mr. Waddell if he had found it necessary to take charge of the oil gas up to the point of combustion, or if they had ever had any difficulty in burning the gas, or in dealing with the consumers.

Mr. Waddell said they would notice that their gas had never been very high, and he had never had any difficulty to speak of. For about two months in the winter time they made gas of about 28 candles. That was too high, and there was a little trouble at that time, but never since. If Mr. Hall was thinking of condensation, he might say—and he thought there were some there who could confirm him in that (at least he could speak for his own town)—that the traps had never been pumped since he went to Broughty Ferry. There was nothing in them, and he understood that they had not been pumped for the last eight years. It was rather a peculiar circumstance, but it was so.

Mr. Hall said it was the burners he referred to—the consuming of the gas.

Mr. Waddell said he had had no difficulty excepting during the two months in which he was making gas of a quality up to 28 or 29 candles.

Mr. J. Ballantyne (Rothesay) said he had not intended to take part in the discussion, for the simple reason that he had had no opportunity of doing anything with the oil process, as they had not even a corner in their works to place it in. They were soon going to have new works, and he did not know what they might then do. A great deal had been said with regard to the price of coke. He understood that the prices mentioned in the paper referred to coke from splint coal, and not to coke from oil. He wanted to ask whether those who were using the oil process found any difficulty in disposing of the coke from the oil, and at what price. He had a hint some little time ago that there was a difficulty about it, and that there was not much more than half the price being realized for this coke that they were led to expect they would get. He would like to get information upon this point.

Mr. Bell said he would like to answer the question, so far as he was concerned. Last year he sold the whole of his oil coke (he sent it to Armstrong's works at Elswick) at the price of $4.87 per ton.

Mr. Waddell said it was only in the first part of the year that they had coke to sell, and they wished to sell it in the place if possible. Some of their buyers were not quite prepared to start with the oil coke at first, but they had now made a contract for the year at $4 per ton. Since the contract was made, they had had complaints from more than one consumer in the place, that they had sold all the coke to one party.

The President said the question of coke seemed to be bulking very largely in the discussion. He did not see why the oil coke could not be got rid of. The coke from his station alone, in Glasgow, was at least 80,000 tons a year; and they got rid of it at $1.50 per ton. They sent it a long way past Fife. Perhaps one of the reasons why they obtained a better price for coke was that it was of better quality, by reason of their using a better coking coal. He did not think there should be any difficulty in getting a market for coke, if it was of exceptionally good quality, when they in Glasgow got rid of what he might call their poor coke. He thought they were all indebted to Mr. Waddell for having had the courage to bring forward his figures. It was the pounds, shillings and pence that were the root of the matter in the end. Each man had to take his own surroundings, and the circumstances connected therewith, into consideration; but there should not be such a great deal of difference due to locality, but what could be given in figures. If the figures were given as fair as possible, it would be easy to judge of the benefit to be realized from any innovation. He thought they were certainly very much indebted to Mr. Waddell for giving them the figures he had. The only mistake, he thought, was that the figures were too small; if they had been larger, there might have been a better discussion.

Mr. D. M. Nelson (Glasgow) said that no reference had been made by Mr. Waddell's setting of retorts. One of the crucial defects of iron retorts was the want of a proper setting. Now, having taken some interest in the longevity of iron retorts, he (Mr. Nelson) would say that Mr. Waddell had fallen upon a condition of matters in which the life of the retorts would be preserved. He had seen, during the last eight or ten weeks, a setting of retorts discarded because of their being burned out. Now, he thought this would not happen in the case of Mr. Waddell, because he had allowed a certain space for the flame to pass through, so as to heat the retort pretty regularly all over, which would thereby maintain its life.

Mr. Waddell said his paper was nearly altogether a matter of figures, and his desire was that the figures should have appeared more clearly. He said, in his paper, that circumstances had had a great deal to do with the matter; but it was also true that, so far as the coke market was concerned, they were largely assisted by the Peebles process in this way, that it enabled them to use a quality of coal that made a good coke. This was due, to some extent, to the Peebles process. With regard to the comparing of the past with this year's working, Table A gave a fair comparison with last year, with the same price of coal, of shale, and of splint. The circumstances were all the same in this particular case. Table B had the same price of coal again, but with regenerative settings. In Table C they had regenerative settings and the Peebles process. He thought it might be a little interesting to call the attention of the members to the changes from the one to the other. He thanked the meeting very much for the generous way in which they had treated his paper. He had been very anxious to place the matter as plainly and as clearly as he could before them; and if they thought there was anything wrong with the figures he had given, they might just turn back to the reports by others.

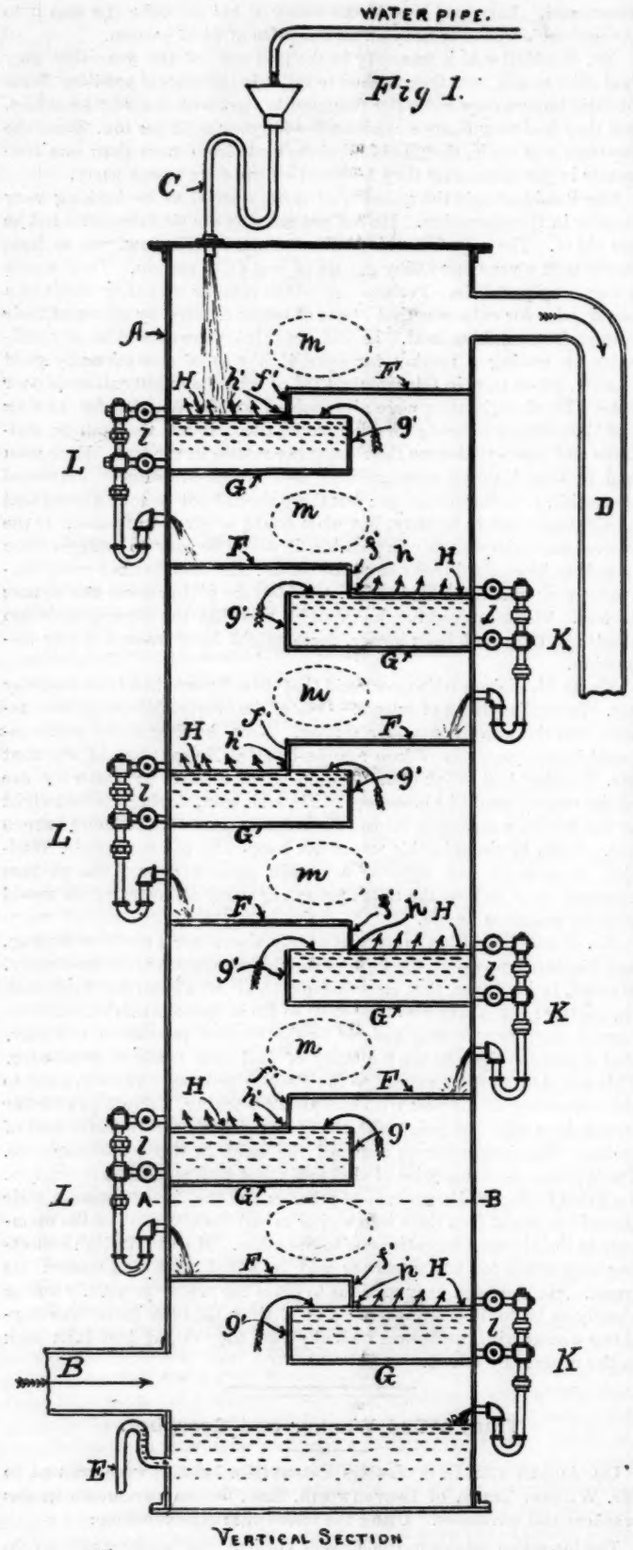
Tracy's Gas Washer and Scrubber.

On August 27th U. S. Letters Patent (No. 542,392) were granted to Mr. William Tracy, of Leavenworth, Kas., for improvements in gas washers and scrubbers. Using the words of the specification:

The invention relates to the class of vertical gas washers and scrubbers, the gas entering at or near the bottom of the structure and the water entering at the top; and it consists in certain specialties of construction and in combinations which will clearly appear from the description below. The apparatus is also adapted for use as a washer on one side and as a scrubber on the other side, and the casing may be

built square, round, or otherwise, as circumstances or location may require.

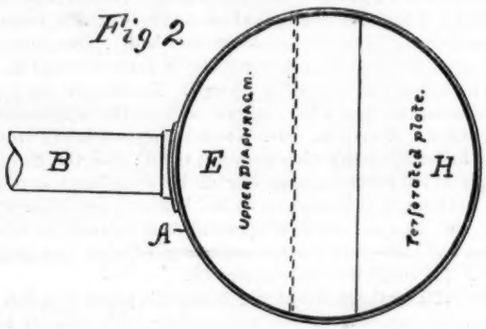
In the drawings, Figure 1 illustrates a central vertical section of one form of apparatus embodying my invention; Fig. 2, a cross section on the line *A B* of Fig. 1; Fig. 3, a top view, enlarged, of one of the diaphragms and its perforated hinged plate; Fig. 4, a central section of the same and with the hinged plate shown in dotted line as when raised; Fig. 5, a section enlarged and in perspective showing the relative positions of the upper and lower portions of the several diaphragms; Fig. 6, a side view, enlarged, of the lower portion of the diaphragm; and Fig. 7, a top view of the same enlarged.



VERTICAL SECTION

A indicates the case; *B*, the gas inlet; *C*, the water inlet; *D*, the gas outlet, and *E* the water outlet.

Within the case I make a number of partitions of special construction, placed one above the other, and each adapted to serve as a water seal. They are each composed of an upper diaphragm *F*, extending more than half way across the case, as shown, having a downwardly projecting flange *f'*, and of a lower diaphragm *G*, extending from the opposite side of the case and reaching more than half way across it, and having an upwardly projecting flange *g'*, this flange *g'* reaching, as shown, to a height somewhat higher than the lower edge of the flange *f*, so that

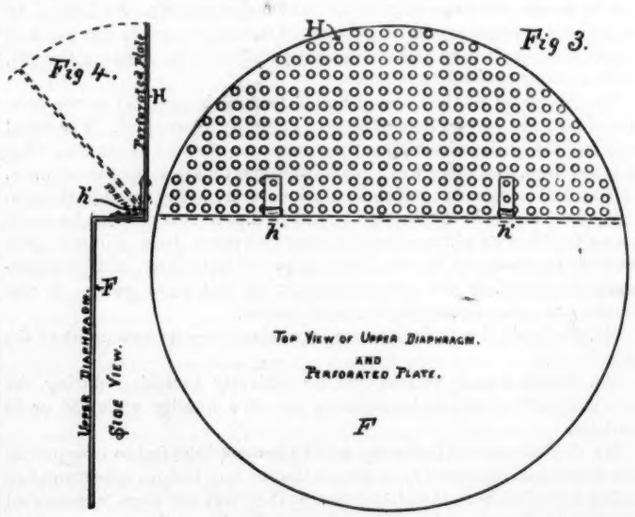


CROSS SECTION ON LINE A.B. LOOKING DOWN

when the lower diaphragm *G* is filled with water, flange *f'* shall dip into the water, thus making a water seal. Every other one of these partitions has its diaphragm *G* at one side of the case and the remainder at the opposite side, as shown. Each diaphragm *F* has hinged to its flange at *h'* a sealed, perforated segmental plate *H*, whose outer or curved edge rests, as shown, on a suitable support on the case, this plate being in a plane somewhat lower than that of the top edge of the flange *g'*.

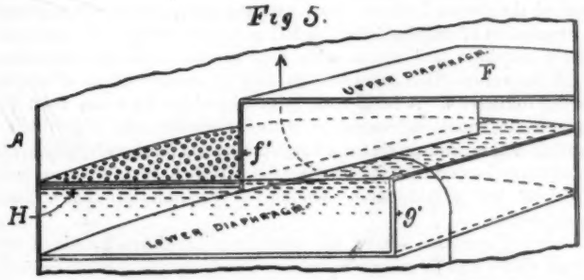
I make suitable manholes in the case in front of each section for easy access thereto for the purpose of cleaning, as shown in dotted lines at *m* in Fig. 1, and by raising the hinged perforated plates this cleaning of each section can be easily done without removing any part. The number of the diaphragms may be as many as desired.

A pipe *L* outside of the case is connected severally with the water holding diaphragms on one side of the case, and another pipe *K* similarly connects with the corresponding water holding diaphragms on the other side of the case, each pipe having suitable valves *l l*, each of these pipes being adapted to discharge as need be inside the case at a point below one of the lowermost diaphragms.



The operation of the apparatus is as follows: Water having entered at the inlet *C* to fill successively each of the lower diaphragms or water chambers *G* by reason of the overflow of the top one, when filled to the sealing line, dropping to the next diaphragm *G*, and so on successively till all are sealed. The gas is now permitted to enter through gas inlet *B*, and by reason of the water sealing must follow the only course left for it, as indicated by the arrows—that is, first up and, say, to the right, over the edge *g'* of the lower diaphragm *G*, thence downward into the water therein, thence under the ledge *f'*, and upward through the perforated sealed plate *H*, upon which water may be continually dropping, as shown, from the diaphragm next above it. The gas continuing upward must now turn to the left to enter the water in the second diaphragm, and thence through it and under the ledge *f'*, and out through the perforations *D* of this diaphragm, and so on successively with each

Fig 5.



— SECTIONAL SKETCH SHOWING RELATIVE POSITION OF DIAPHRAGMS. —

and all of the diaphragms, until its final escape through the gas outlet *D*.

When in full operation, it will be understood that the entering gas in passing to the first section or diaphragm is carried under the strongest liquor—namely, that in the bottom diaphragm—and the water entering at the top being clean, the gas in travelling to the top becomes thoroughly washed and cleansed from ammonia and deprived of a good portion of the carbonic acid and sulphureted hydrogen.

By opening all the valves *l* on one side of the case the water is allowed to pass out from all the water holders *G* at that side, and unseal all the partitions at that side, while at the same time the valves on the other side remaining closed the partitions at that side remain sealed, and thereby the apparatus at once becomes a washer at one side and a scrubber at the other.

The whole structure is a simple, cheap and effective washer-scrubber for all small gas works.

The claims are:

1. A gas scrubber having within its case a series of horizontal partitions, one above the other, each composed of an upper and a lower flanged diaphragm, as set forth, extending from opposite sides of the case to and beyond its center, the upper one having a perforated plate

Fig 6.

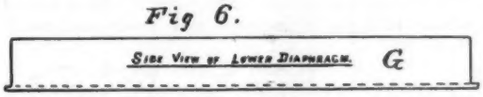
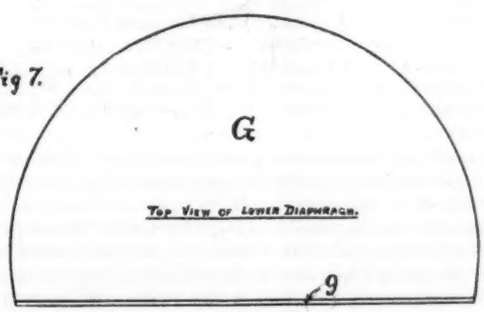


Fig 7.



reaching from its flange to the wall of the case, and such flange dipping into the lower diaphragm below its highest water line.

2. In a gas scrubber partition composed of the parts *F* and *G*, projecting from opposite sides of the case and having the ledges *f'* and *g'*, respectively, the ledge *f'* extending downward below the upper edge of *g'* and forming a seal—a perforated plate hinged near the center of the case to the part *F*.

3. In combination with the case and with its gas inlet and outlet, the described series of upper diaphragms having each a ledge *f'* to form a seal, the perforated plates and water chambers, all located alternately at opposite sides of the case, and the pipes *l l* at opposite sides of the case, each of said pipes connecting with said alternate water chambers.

4. In combination with the casing and its described flanged partitions, the upper flange being adapted to dip into water to make a water seal, the described series of perforated plates, each hinged near the center of the case and each constituting a part of a diaphragm, and located alternately at opposite sides of the case and in proximity to the manholes.

5. In combination with the case and its diaphragms, and their ledges *g'* and *f'*, the latter serving to form a seal, the perforated plates, the pipes at opposite sides of the case and each connected to alternate water trays located on opposite sides of the case, and valves in said pipes, and whereby upon opening all the valves in one of said pipes, the apparatus is made to serve as a washer at one side, and as a scrubber at the opposite side.

The Electrical Power Transmission Plant at Folsom, Cal.

In further mention of the electrical power transmission plant at Folsom, Cal., which is rapidly nearing completion, we may say that the project includes the damming of an important river (the American river), the building of a canal over two miles long and the transmission of 5,000-horse power 24½ miles to a large city, where it is to be used for almost every purpose to which electricity may be adapted. In addition the spent water is used for irrigation purposes, and it is calculated that not less than 400,000 acres of land may be rendered fertile by the water after it has been used in the turbines. The following account of the work is taken from *Industry*, of San Francisco:

This great work is by no means a new one so far as the water power is concerned. It was commenced in the early sixties by the Natoma Water and Mining Company. The credit of its inception is due to the late Hon. H. G. Livermore, President of the Natoma Water and Mining Company, a pioneer, who, born in the State of Maine, and reared where every stream gives up its power for the benefit of manufacture, early saw the advantages of the American river at Folsom for such a purpose. The first intention was to utilize the power at the town of Folsom, and there erect extensive mills, but the recent and rapid advancement in electrical devices for the transmission of power by electricity has rendered it possible to send the power produced at Folsom over wires to Sacramento.

The dam, canal and permanent works of the Folsom Water Power Company, at Folsom, Sacramento county, Cal., have been finished for several months. The Company have now entered into a contract with the Sacramento Electric Power and Light Company, transferring to them the total power resulting from the fall of the water flowing in the line of their canal, save what is reserved for the State of California in return for labor furnished in the construction of the canal.

This transfer of power to the Electric Company amounts to many thousand horse power, and the Electric Company have contracted with the General Electric Company for the installation of a power plant and double transmission lines to convey 4,000 electrical horse power from Folsom to Sacramento. This power will be distributed for propelling the electric car lines of the Sacramento Electric Power and Light Company, for lighting and for general power purposes.

The power houses at both Folsom and Sacramento are now in course of erection. The dam, canal and power house are built in the most substantial manner, requiring more than 23,000 barrels of the best Portland cement in their construction. The dam is 89 feet high, 24 feet wide on top, 87 feet wide on the bottom, and the dam and head works are upward of 650 feet long. A heavy granite wall, built from the bed rock and 8 feet wide on top, forms the outer border of the canal for a long distance at its upper end, and the inner side of the outer bank is protected by a facing of masonry most of the entire length.

The canal of the Water Company is 50 feet wide at the top, 40 feet wide at the bottom and 8 feet deep, flowing 85,000 cubic feet per minute. The fall at Folsom is about 80 feet, but only 55 feet of this head will be applied on the wheels, the water being discharged 25 feet above the bed of the river, so the water can be led into an irrigating canal extending to the plains between Folsom and Sacramento and irrigating a large area thousands of acres in extent.

The electric transmission is, next to that at Niagara, the most extensive in this country. The distance of transmission is 20 miles. The water wheels, eight in number, are of the pressure type, made at York, Pa., by the S. Morgan Smith Company, arranged in pairs, each pair of wheels generating 1,260-horse power at a speed of 300 revolutions per

minute under a head of 55 feet. Separate wheels are used for the exciters and regulation is effected by means of a Faesch and Picard governor acting on the induction issues of the wheels, also by heavy flywheels on the water wheel shafts.

The generators will be connected directly to the water wheels, and are of the three-phase alternating type, four in number, each of 1,000-horse power and to weigh 30 tons, to operate at 800 volts. This pressure or voltage is raised for transmission to 11,000 volts, and the lines with all accessories arranged for this high voltage. The whole of the electrical equipment is supplied by the General Electric Company, including generating, transmission and distribution. The poles, 2,600 in number, to support the wires are of cedar, 16 inches diameter at the bottom, 40 feet long, having at the top cross bars to support the two circuits.

The whole plant is arranged in duplicate. The forebay to the wheel is double, so that one side can be shut out for cleaning if necessary without stopping all the wheels, and the transmission line is also double, consisting of two lines of poles, one on each side of the county road all the way from Folsom to Sacramento, thus making it possible to shut the current from either line in the event of repairing, or for other purposes.

In the generating and also the receiving houses, the switches are so arranged that all the machines are interchangeable. The receiving house in Sacramento is a large two-story building, entirely fireproof, as is also the building in Folsom. In the upper stories are installed the step down transformer, with necessary switches, and in the lower story are installed the railroad motors, the light machines, power motors, etc., with all the necessary switches for operating the same.

The cost of constructing the dam, head work and canal was $1,217,363, involving 700,000 days' work of convict labor, provided by the State. Material expense, etc., as follows:

23,000 barrels of Portland cement	$69,418.95
Sand and gravel for concrete	6,660.95
Construction machinery	25,000.00
Fuel for locomotive, hoisting engine, drills, etc	20,178.87
Explosives	8,273.44
Gate machinery	25,838.19
Railroad	16,595.78
Engineering	21,490.95
Lumber	4,595.91
Buildings	1,046.08
Materials, tools and steel	35,522.80

The dam and head works contain 37,000 cubic yards of granite masonry, and the excavations measure 12,000 cubic yards.

It should have been mentioned that there are two canals, one on each side of the river, the principal one being on the eastern side. This latter is divided into three sections; the first section extends from the dam to a point just below the first or State fall, which is a drop of 7.33 feet. This section is cut much of the way into solid granite cliffs, the rock from this cutting going, however, most of it, into the dam and head works on the east side, and into a heavy masonry wall 8 feet wide on the top and in some places 30 feet high, built on the bed rock, and which forms the outer bank of the canal. In this section four sand gates are provided. This section is about 2,000 feet long.

Section 2 is constructed with an outside bank, earth and rock filling, on which is laid a broad gauge railroad track. At the lower end of this section are located four deep outlet gates, raised and lowered by hydraulic cylinders. The outer bank of section 2 is faced on the inner side by a masonry wall, and the outside facing of the bank is protected against the river by a heavy rip-rap. Section 2 is 4,000 feet long.

Section 3 is made by earth and rock excavation, and an earth-rock bank fill, forming outer bank of canal, which, as in section 2, has a railroad track on top. The bank is protected on the outside by rip-rap, and in some parts of the inside faced with dry rubble wall. Section 3 is 3,500 feet long, making total length of canal 9,500 feet.

Above the head gates the east canal is 66 feet wide, at the upper end of section 1; below head gates to State fall it is 53 feet wide on top and 45 feet wide on bottom. Sections 2 and 3 are 50 feet wide on top and 40 feet wide on bottom, carrying water 8 feet deep, with such a grade as to afford a flow of water in the canal of more than 85,000 cubic feet per minute.

The Folsom Water Power Company was incorporated October 14, 1881. The officers of the Company are: Chas. E. Livermore, San Francisco, President; H. P. Livermore, San Francisco, Treasurer and Manager; Joshua Barker, San Francisco, Secretary; H. T. Knight, Folsom, Engineer.

The Purification of Boiler Feed Waters.

Dr. Francis Wyatt, writing in *Engineering and Mining Journal* on the purification of boiler feed waters, remarks that the nature of the injury inflicted upon a boiler, and the degree of corrosion or incrustation produced in it, alike depend upon the character of the available water supply. If a water contains more than five parts per 100,000 of free sulphuric or nitric acid, for example, it will certainly cause serious corrosion, not only of the metal of the boilers itself, but of the pipes, cylinders, pistons and valves with which the steam comes in contact. It is true that such waters are not common, but in the coal and iron districts sulphuric acid is sometimes very troublesome. Iron pyrites are oxidized to sulphate of iron, and the soluble sulphate is washed out from the strata and carried into the streams. The presence of organic matter taken up by the water in its aftercourse reduces the iron; the bottom of the stream becomes lined with the red oxide, and a considerable proportion of sulphuric acid is left in the free state. In some other places muriatic and nitric acids may be conveyed into the water through the refuse discharged into streams by various kinds of manufacturing industries. A large total mineral residue in water used for making steam, causes incrustration of the interior linings of the boiler, clogs their action, and produces a very dangerous hard scale, which not only involves loss of fuel, by offering great resistance to the transmission of heat, but is liable at any moment to crack and produce a disastrous explosion.

The kind of hardness known as "temporary" is characteristic of waters from chalk and limestone formations, and is attributable to calcium and magnesium bicarbonates. Otherwise expressed, it is due to the carbonates which depend for their solubility in water on the presence of carbonic acid gas. It follows from this that by merely boiling such waters for a sufficient time to expel all the carbonic acid they may be very readily made soft, and this would, therefore, be the simplest plan to adopt in all cases if it were not for the fact that where very large quantities of water are required for daily use boiling becomes not only troublesome, but very costly. An equally satisfactory and more practicable method of softening consists in adding to the water so much of freshly burnt lime as will suffice to absorb the carbonic acid and throw out of solution, with the earthy carbonates, any iron and the greater portion of any organic matter present. To those who are not familiar with this beautiful and yet simple process, its rationale may easily be made clear. In the first place, waters of "temporary" hardness contain lime and magnesia in solution, probably in the form of bicarbonates, thus:

$CaCO_3$	+	H_2O	+	CO_2	=	$CaH_2(CO_3)_2$
Insoluble carbonate of lime.	+	Water	+	Carbonic Acid Gas.	=	Soluble bicarbonate of lime.
$MgCO_3$	+	H_2O	+	CO_2	=	$MgH_2(CO_3)_2$
Insoluble carbonate of magnesia.	+	Water	+	Carbonic Acid Gas.	=	Soluble bicarbonate of magnesia.

If burnt lime (CaO) be added to this water it will at once, in its avidity for carbonic acid gas, degrade the bicarbonates and render them insoluble, thus:

$CaH_2(CO_3)_2$	+	CaO	=	2CaCO	+	H_2O
1 part of soluble bicarbonate of lime.	+	1 part of burnt lime.	=	2 parts of insoluble carbonate of lime.	+	Water.
$MgH_2(CO_3)_2$	+	CaO	=	$MgCO_3 + CaCO_3$	+	H_2O
1 part of soluble bicarbonate of magnesia.	+	1 part of burnt lime.	=	1 part insoluble carbonate of magnesia.	+	1 part insoluble carbonate of lime.

+ Water.

The quantity of burnt lime required to bring about this softening reaction in 1,000 gallons of water is approximately 1¼ ounces for every part per 100,000 of temporary hardness, as determined by the soap test. In practice, the lime is placed in a large bucket and thoroughly slaked, the thick milk is poured off into about 300 gallons of water in the water tank, care being taken to add none of the sediment or lumps. The residue is continuously mixed up in the bucket with more water, and the milk is poured off into the tank, until all the lime has been used up; 700 gallons of the water are then rushed into the tank with sufficient force to insure a most complete agitation and mixture of the contents. If the flow of water is not strong enough for this purpose, the mixture must be made by means of suitable stirring apparatus, either by hand or mechanically. The appearance of the water will now be very milky, and it must either be allowed to stand and settle for several hours, or must be filtered through a filter press in order to remove the carbon-

ates. The proportion of lime to water may be very accurately adjusted during the running in of the water to be softened, by withdrawing small samples from the tank every five minutes in a small white cup, and adding to it a drop or two of solution of nitrate of silver. As long as there is burnt lime present in excess, the silver will produce a brownish coloration, and as soon as this becomes very faint, and hardly distinguishable, the flow of water must be stopped.

The kind of hardness in boiler feed water which is called "permanent," is chiefly due to sulphates of lime and magnesia, and it is necessary to alter these by chemical treatment, either outside or within the boiler. The object of the treatment is to produce soluble salts, which upon concentration will not form a scaly deposit, and there are many ways of accomplishing this end. One of the most popular is by the use of either sodic carbonate or hydrate, the former being preferable for lime, and the latter for magnesia hardness. The reactions that take place may be illustrated as follows:

$$\left.\begin{matrix}CaSO_4\\ \text{1 part of sulphate of lime.}\end{matrix}\right\} + \left\{\begin{matrix}Na_2CO_3\\ \text{1 part of Sodic carbonate.}\end{matrix}\right\} = \left\{\begin{matrix}CaCO_3\\ \text{Carbonate of lime.}\end{matrix}\right\} + \left\{\begin{matrix}Na_2SO\\ \text{Sodic Sulphate.}\end{matrix}\right.$$

$$\left.\begin{matrix}MgSO_4\\ \text{1 part of sulphate of magnesia.}\end{matrix}\right\} + \left\{\begin{matrix}2NaHO\\ \text{1 part of Caustic soda.}\end{matrix}\right\} = \left\{\begin{matrix}MgH_2O_2\\ \text{Magnesia hydrate.}\end{matrix}\right\} + \left\{\begin{matrix}Na_2SO_4\\ \text{Sodic Sulphate.}\end{matrix}\right.$$

If the insoluble carbonate or hydrate be filtered off or allowed to settle out, the sodic sulphate remaining in solution has no scale forming or other injurious effect on the boiler metal; and in general practice boiling the water in an outside open vessel for fifteen minutes with sodic hydrate in the proportion of 2 ounces, or with dry sodic carbonate in the proportion of 2½ ounces for every part of permanent hardness per 100,000 and per 1,000 gallons water, gives good results. The chief defect in the process is the impossibility of removing all the lime and magnesia on account of their slight solubility in water, and in many cases this defect is a fatal one, because magnesia hydrate is the most troublesome of all scale formers, in that it is more readily baked, much harder and most difficult to remove.

When it is necessary to treat the water within the boilers themselves, the use of caustic alkalies is not so advisable, and they may be replaced with advantage by either sodic tannate, sodic triphosphate or sodic bichromate, all of which have a specific chemical action. That of sodic tannate consists in forming soluble calcic or magnesic tannates, and soluble sulphates or chlorides of sodium. That of trisodic phosphate produces soluble sulphates, and fine and granular precipitates of calcic and magnesic phosphates, which do not adhere to the plates, and which are readily and easily blown off. That of sodic bichromate produces equally fine and granular precipitates of calcic and magnesic chromates, as well as soluble sulphates, as may be inferred from the equations:

$$(1)\ CaH_2(CO_3)_2 + Na_2Cr_2O_7 = CaCrO_4 + Na_2CrO_4 + 2CO_2 + H_2O$$

1 part bicarbonate of lime. + 1 part bichromate of soda. = 1 part chromate of lime. + 1 part chromate of soda. + 2 parts carbonic acid. + Water.

$$(2)\ CaSo_4 + Na_2C_2O_7 = CaCrO_4 + Na_2So_4 + CrO_3$$

1 part sulphate of lime. + 1 part bichromate of soda. = 1 part chromate of lime. + 1 part sulphate of soda. + Chromic acid.

$$(3)\ MgSO_4 + Na_2Cr_2O_7 = MgCrO_4 + Na_2SO_4 + CrO_3$$

1 part sulphate of magnesia. + 1 part bichromate of soda. = 1 part chromate of magnesia. + 1 part sulphate of soda. + 1 part chromic acid.

The use of bichromate of soda in very slight excess as a boiler compound has not hitherto received much attention, and its properties in this connection are, therefore, generally unknown. It was long supposed that the calcic or magnesic chromates formed in the above equation would be again decomposed into sulphate or carbonate by the alkaline soda salts in solution, and that the reactions would, therefore, go on repeating themselves in an endless chain, and produce no practical effect. This supposition was based upon what takes place in boiling solutions in open vessels and without any reference to high pressure. Experiments have demonstrated that at high pressures the action is reversed, and that the earthy chromates are undoubtedly all deposited and very readily removed by "blowing off." Even if an excess of sodic chromate continuously remains in solution, however, it can have no action whatever on the boiler, and the use of bichromates, in the proportion of 2½ ounces for every part per 100,000 of permanent hardness in 1,000 gallons of water, has the additional advantage over all other scale preventers of furnishing perfectly neutral steam and chemically pure distilled water.

In introducing a boiler compound, of any nature, directly into a boiler, it should be the constant aim to avoid using excessive quantities at any one time. If this precaution be neglected the material is most likely to be either used up or wasted every time the boiler is blown off, or to produce very unfavorable results on the boiler metal. It is far better to add a definite quantity of the chemical each day, and to regulate it according to the amount of water to be evaporated and the amount of salts that are to be transformed from the insoluble to the soluble form.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. CHARLES A. WATERS has resigned the Superintendency of the Adams (Mass.) Gas Company. We understand that his duties as Superintendent of the local water works—a position also held by him for some time—have increased to the point of requiring his sole attention for their direction.

WE regret to report the death of Mr. George Edward Hersh, President of the York (Pa.) Gas Company, who died at his home in York on the morning of September 3d. Deceased was born in Gettysburg, Pa., January 21st, 1822, and removed to York in 1849, where he engaged in mercantile business. In 1860 he was a prominent coal factor in York, and in 1862, in connection with Messrs. Jas. B. Welsh and John B. Hough, he purchased a colliery near Mount Carmel, the trio reaping a large profit from the operation thereof. Besides being President of the York Gas Company, deceased was also President of the York National Bank and the Farmers Fire Insurance Company, and Treasurer of the York and Liverpool and the York and Maryland Line Turnpike Companies. His wife, a son and two daughters survive.

THE Chatham (Ont.) Gas Company has entered suit against the Chatham Water Works Company for damages to its mains occasioned by the negligent methods followed by defendant when burying its water pipes.

MAYOR WARWICK, of Philadelphia, some days ago informed the Councilmen of that city that the "Department of Public Works is in urgent need of money * * * for the construction of a gasholder at the Point Breeze works." He closed his remarks on this topic by saying: "In my judgment, and in that of the Director and Chief of the Gas Bureau, this is absolutely necessary, both for the proper maintenance of the gas works as a whole, and for the stability of the gas supply to a large part of the city of Philadelphia." Shortly after the receipt of the Mayor's communication, Councilman Hicks introduced an ordinance in Councils providing for an appropriation of $190,000, for the construction of a new holder at the Point Breeze station.

THE incorporators of the Leonia Company (A. D. Bogert, L. Bogert and M. Du Bois Appleton), have filed articles. The purposes of the Company are "to buy and sell land, transact a mercantile business, and maintain a gas plant." Leonia is a small place in Bergen county, N. J., on the line of the Northern Railroad of that State, at a point 12 miles north of New York. As it is about midway of Hackensack and Englewood, each of which places supports an enterprising Gas Company, and either of which could easily supply Leonia with gas, we are at a loss to comprehend the true inwardness of the "Leonia Company's" desire to engage in gas manufacture.

THE Boston newspapers give the following figures respecting the output of the combined Gas Companies of that city under the control of the Bay State Gas Company for the periods mentioned:

July,	1894	66,000,000 cubic feet.
"	1895	86,000,000 "
Aug.,	1894	76,081,000 "
"	1895	90,591,000 "

WE are informed that the Common Council of Escanaba, Mich., has taken over the gas and electric plants of the Escanaba Lighting Company, and has paid the first installment of $5,000 on the purchase price agreed upon—$70,000. The Commissioners named by the city to supervise the operations of the plant are Messrs. Solomon Greenhoot, D. Mead and W. W. Oliver.

THE management of the Washington (D. C.) Gas Light Company seems to be quite successful in getting itself in hot water.

"OBSERVER" forwards the following: "At a meeting of the Newburyport (Mass.) Common Council, President Curtis submitted a com-

munication from the Mayor relative to the order passed by Council requesting the Newburyport Gas Company to make a reduction in its selling rates. The Mayor's brief was as follows: 'In accordance with an order passed by the City Council, requesting me to confer with the officials of the Newburyport Gas and Electric Light Company, with a view of obtaining for our citizens a lower price for gas, if possible, than they are now paying, the present price being $2.50 per 1,000 cubic feet, with 10 per cent. discount for cash in 10 days, for small consumers, and 20 per cent. for all using over 1,000 cubic feet per month, I would say that I had a conference with the officials of the Company, and was informed by them that, after the 1st of October next, they would furnish gas at the rate of $2 per 1,000 cubic feet, with a discount of 5 per cent. to all consumers, which would make a difference in the net price of 10 cents per 1,000 cubic feet to large consumers and 35 cents to small consumers. I was informed by the officials of the Company that it is as low as they can afford to furnish gas, but if the increase in consumption will warrant it they would make another reduction. The Directors of the Gas Company are men in whom the citizens have confidence, and I believe they are disposed to do what is right, but we certainly cannot expect them to furnish gas without a reasonable profit. It seems to me that the only way for us to obtain a low price for gas is by increasing the consumption, and I find in looking over the report of the Board of Gas and Electric Light Commissioners that such is the view taken by them in cases where other places have petitioned them to oblige gas companies to furnish gas at a lower rate.' There is no doubt that the authorities of Newburyport will accept the concession offered by the Company, and thus end the debate without an appeal to the State Board."

THE official gas inspector for Chicago (Mr. Westman) has completed the fitting up of a photometer station in a room in the City Hall.

THE new holder for the Rockland (Me.) Company is in working order.

THE Woonsocket (R. I.) Electric Machine and Power Company, which concern it will be remembered refused to obey the order of the Board of Gas and Electric Light Commissioners, directing it to supply public arc lamps to the adjoining town of Blackstone, Mass., at the rate of 42 cents per lamp per night, has been notified by the Commissioners that its refusal to obey the mandate has been referred to the Attorney General.

THE following explanation of the sad happening at the Providence (R. I.) gas works (briefly referred to in our issue for last week), by which five of its workmen lost their lives, is from Mr. A. B. Slater, Secretary and Treasurer of the Company—we prefer to use Mr. Slater's account, rather than to obtain our facts from the number of the Providence *Journal* forwarded by Mr. Slater, for his recital is plain, concise and understandable:

PROVIDENCE GAS COMPANY, Market Square,
PROVIDENCE, R. I., September 9th, 1895.

To the Editor AMERICAN GAS LIGHT JOURNAL: Replying to yours of the 7th inst., I mail to you a copy of the Providence *Journal*, of the 5th, which will give you an account nearest to correctness of any that has appeared in the papers. I was returning from a short vacation, on my way from Montreal to Portland, when the unfortunate accident occurred; but from the best information I can obtain have learned that it was reported to the Superintendent of the West Station (in whose district the gasholder is located) that the valve was out of order and could not be opened. Knowing that it should be attended to as soon as possible—for a certain district depended largely on this holder for its supply—as soon as he could spare the proper men, he sent (on Tuesday morning, the 3d inst.) them to the valve house. He accompanied them and gave them explicit directions how to proceed. The valve house is about 12½ feet square and 7 feet deep, with two openings (each about 3 feet square) in the floor, usually covered with open gratings, but which were taken out at this time for light and air. The boxes were filled with water, shutting the gas off from the holder side, and on the outside of the valve a rubber bag was inserted, which shut the gas off from the street side. The work necessary to be done took the time up to Wednesday noon, the 4th inst. The Superintendent left them just before noon, telling them he would return after dinner, when they would take out the valve; but, unfortunately, they proceeded to take it out before his arrival, probably feeling confident that everything was all right, and being familiar with such work. They got the rubber bag in all right, and had a test hole between it and the valve, to be sure that the gas did not get by the bag. The valve was then taken out, and while they were placing it aside, the bag gave way (ruptured), and in endeavoring to put on the plate, which was all ready, they were suffocated before they realized it. Had they heeded the explicit directions of the Superintendent, when they first started upon the work, that if any leak of gas took place, from any cause, to get out immediately, they could have held their breath long enough to have mounted the few steps which would have brought them into the open air. But their endeavor to stop the escape of gas was fatal. This is the only instance, during the 48 years' existence of the Company, that we have lost any of our men from suffocation. There is no man more careful and cautious than the Superintendent, and the men were the best men we had for all such work. Furthermore, they were fully experienced in such work. Yours, very truly, A. B. SLATER.

THE new holder for the Hagerstown (Md.) Light and Heat Company, the rated capacity of which is 75,000 cubic feet, will be completed by December 1st. The contractors are Messrs. Bartlett, Hayward & Co.

MR. EUGENE VANDERPOOL has established himself in comfortable quarters on the second floor of the structure known as the "Old Bank Building," corner of Broad and Bank streets, Newark, N. J., where it is needless to say he will be glad at all times to welcome the visiting gas man.

MR. HENRY G. KULP, Treasurer of the Pottstown (Pa.) Gas Company, died on the evening of the 3d inst., after a short illness. Deceased was in his 49th year, and was well known and respected. Besides his connection with the Gas Company, Mr. Kulp was Treasurer of the Perkiomen and Reading Turnpike Company and the Pottstown Cemetery Company, and was also a Director in the Security Company and the National Iron Bank. He was prominent in the management of the Pottstown Hospital, and served several terms on the Council and as Burgess.

THE Vancouver (British Columbia) Gas Company offers to perform the public lighting under the following conditions: To maintain 350 lamps, fitted with double Welsbach burners, 320 nights in the year, for $18 per *burner* per year, and to furnish gas to the public buildings at the rate of $1.50 per 1,000 cubic feet, provided the city subscribes $125,000 to enable the Company to make the necessary plant extensions, the city to receive paid up stock in the Company at par to secure the loan. It is also specified that the contract is to run for 10 years. The Company also offers to sell all its property to the city for $350,000.

WHILE there is nothing particularly new in the following, which is taken from the Newark (N. J.) *News*, of the 4th inst., we reprint it as a matter of record, that may possibly be of value for future reference: The much-talked of consolidation of the Newark Gas Light and the Citizens Gas Light Companies, of this city, over which negotiations have been pending several years, was consummated yesterday afternoon. The outcome was the formation of a new Company known as the Newark Gas Company, with a capitalization of $5,000,000, consisting of $4,000,000 bonds, secured by a mortgage on the entire plant, and $1,000,000 stock to be preferred, with cumulative interest if any additional stock is issued. The old Companies were capitalized at $1,000,000 each, divided into 20,000 shares. Under the new apportionment the holders of the Newark Gas Light Company stock will receive $2,500,000 of the new Company's bonds in return for the 20,000 shares of stock surrendered. Stockholders of the Citizens Company, who also surrendered 20,000 shares of stock, will receive the remaining $1,500,000 and the entire issue of $1,000,000 stock, all that is to be issued at the present time. While the consolidation is a mutual one, the Citizens Company has practically absorbed the Newark Company, and the Citizens officers and Board of Directors will, it is expected, control the new Company until the annual meeting in February, at least. Efforts to effect the consolidation were commenced as early as 1871, when the Citizens Company practically absorbed the Orange Gas Light Company, which had been incorporated in 1858. The Newark Company at the same time and up to the present was supplying the Montclair Gas and Water Company, which furnished Montclair and Bloomfield, and in this matter the county even outside of Newark was divided between the two Companies. The dividing line in the city was the Morris canal, running west to Warren street, and running along the line of Warren street to Central avenue and the city line. South of this line the city was supplied by the Newark Company, and north of it by the Citizens, and both Companies realized that as the city and townships grew, a vast saving could be effected by a consolidation of their plants and franchises. With that object in view steps were at once taken to secure the consent of

the individual stockholders to the consolidation. This was found to be an exceedingly difficult task, not because the plan was opposed by the stockholders, but because it would be hard to locate the 520 individual owners. Some of the 40,000 shares represented were held in Europe, and in many other cases the owners of stock held here were and had been abroad for years. This was the great drawback to the scheme, for the promoters had determined that individual consent should be had in every instance, and this took years to accomplish. A large majority had consented as early as 1891, and the managers of the consolidation scheme could, had they been so disposed, have completed the work without the consent of the minority, and under the laws of 1893 governing the consolidation of such corporations forced the minority to consent or freeze them out. Such a course, while open, was repugnant and action was deferred until early in August, when the promoters had secured the signature of every one of the 520 stockholders to the consolidation agreement, and an actual transfer of the 40,000 shares of stock to the Trustees of both Companies. The Directors of both Companies met and approved the agreement, and yesterday the joint stockholders met and voted unanimously for consolidation. A special messenger was sent to Trenton with the new articles of incorporation, and as soon as he returned with a certified copy these officers were elected: President, John L. Blake; Vice-President, Stephen H. Condict; Secretary, Clarence L. Nelson; Treasurer, Robert B. Hathorn; Board of Directors, Stephen H. Condict, George B. Jenkinson, John L. Blake, Charles A. Lighthipe, Henry C. Kelsey, George E. Halsey, E. L. Joy, Henry Powles and Andrew Kirkpatrick. Minor details of the organization were arranged, and then the $4,000,000 mortgage to secure the bond issue was formally executed. As Trustees on behalf of the bondholders, Eugene Vanderpool, Marcus L. Ward and Andrew Kirkpatrick were selected, and they will exercise a general supervision over the management of the new Company. President Blake said to-day that no immediate change in the working force was in contemplation and that none would be made unless where changes were found to be absolutely necessary. Both offices will for the present at least be maintained as a matter of convenience, and if consolidated there will be no reduction in the working force. He expressed the belief that the consolidation would operate to the advantage of the city as well as the stockholders. In conclusion Mr. Blake remarked that the unanimity of action on the part of the stockholders showed how ridiculous the rumors recently current, alleging coercion, actually were. It had been determined at the outset, he said, to take no action without unanimous consent, and had a single stockholder objected there would be no consolidation even now. All the contracts and liabilities of the old Companies are assumed by the new Company, with the plants and franchises. The $4,000,000 mortgage was recorded in the County Register's office this afternoon. It is dated September 3d, and covers all the property of the two Companies in this city, Orange, East Orange and Harrison.

Mr. J. B. Stetson, President of the Edison Light and Power Company, of San Francisco, Cal., says that if the San Francisco Gas Company goes into the electric lighting business his Company will construct and operate a gas works.

Mr. Stevenson, of Toronto, Canada, was the man selected by the authorities of Westmount, Canada, to prepare plans for and estimates of the construction and cost of a gas works to be operated on municipal account.

We are in receipt of the fall catalogue, issued by Messrs. A. Weiskittel & Son, of Baltimore, Md., which lists all of that firms celebrated lines of Fire King gas stoves and ranges.

The manufacturing plant of the Terre Haute (Ind.) Gas Light Company is to be rebuilt. The retort house is to be equipped with entirely new benches of 6's, to be fired by means of regenerator furnaces, and the bench work is to be constructed by Mr. James Gardner, Jr., of Pittsburgh, Pa. The Kerr Murray Manufacturing Company, of Fort Wayne, Ind., will furnish the hydraulic mains and all other iron work for the benches. The P. H. & F. M. Roots Company will supply a No. 6 exhauster, and the Addyston Pipe and Steel Company, of Cincinnati, will furnish the pipe and specials necessary to increase the Company's main system by perhaps six miles. The expenditure on betterment account will not be less than $30,000.

The Board of Public Works, of Bridgeport, Conn., is considering the application of the Citizens Gas Company for permission to bury its pipes in that city.

Scarcity of Skilled Workmen.

The *Iron Age*, referring editorially to the demand for skilled workers, says:

The increasing activity in the iron and steel trades is developing a scarcity of skilled workmen. Thus far no serious difficulty has been experienced in securing the men needed, but the supply is seen to be steadily growing smaller. Fewer applications are now being made when vacancies are announced or when employers advertise for additions to their force. Only a few months since the reverse was the case. A manufacturer could then make a selection from an enormous number of men of the highest grades of skill in almost every line. Crowds congregated about the gates of an establishment on the day when operations were to be resumed. The rate of wages was not seriously questioned, but employment at some kind of wages was the first consideration with those who had perhaps been long idle. It then seemed as if many months would be required to take up the slack. But the activity in the iron and steel trades has been so pronounced that the supply of capable men has been practically gathered in, and the workmen now available are not to any extent of a desirable class. In some branches of the trade considerable uneasiness is now felt over the outlook for the future. Next year, it is apprehended, the lack of a sufficient supply of good men will be felt quite severely. Especially is this the case in the lines in which a long apprenticeship is essential for the development of the practical skill required.

This is one of the inevitable effects of a protracted season of dullness in a trade. Good men are the least disposed to remain unemployed for any length of time. Preferring to continue in the occupation for which they are specially fitted by reason of their training, they will perhaps await for a reasonable period the resumption of business in the establishment in which they were employed, but when day after day passes with no sign of starting, they turn their attention in some other direction and accept the best chance offered. Some take such money as they have saved and embark in business for themselves. In a few months after a concern closes down its organization is scattered to the four quarters, and the same men cannot possibly be collected. A large percentage of them has drifted into other trades and either will not or cannot return to their old occupations. It might be supposed that the introduction of so much labor-saving machinery in iron and steel works, which has been a conspicuous feature in recent technical progress, would go far toward throwing on the labor market an over-supply of workmen, but these changes after all have not been so far-reaching as the plaints of labor leaders would have us believe. Like all other movements in the direction of progress, their effect has been temporary, and the displaced workmen have evidently found other occupations. The question can be pertinently asked, If old methods were still in vogue in our great iron and steel works, how could a sufficient force of skilled workmen be obtained? It now appears to be absolutely necessary to devise further means of conducting manufacturing operations by labor-saving machinery if the supply of workmen cannot in some way be augmented.

Not only are skilled workmen scarce, but an absolute dearth exists of thoroughly qualified experts to direct department work in large manufacturing establishments. Our mechanical progress appears to be developing at a rate of speed out of proportion to the conventional methods of preparing men to fill the exacting duties now required of them. Within the past few years new industries have grown at a marvellous rate which have made heavy drafts on the ranks of those who either were or were apparently destined to become leaders in the older industries. Opportunities for more rapid advancement or for better financial returns have been seen in the electrical business, in the tin plate trade, or in the manufacture of bicycles or some other comparatively new line.

Again, the growth of old works has advanced men of ability in department work to positions of more general supervision and vacancies have thus been created which are hard to fill. Some of our largest manufacturing companies, who from their position would appear to be well equipped with a technical and practical staff of the most ample proportions, are constantly on the lookout for men of ability and practical and scientific knowledge to fill positions of the character above indicated. Of the mediocre or unskilled we shall probably have no lack, even if a much greater condition of activity should be favored the iron trade. The tide of immigration is again turning toward our shores, attracted by the reports of improving business. But the highest grade of workmen cannot be recruited from that source. They must essentially be a home product, trained in American methods, dominated by American ideas and gifted with American ambition.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

MONDAY, SEPTEMBER 16, 1895.

The Market for Gas Securities.

The city gas share market was dull and uneven for the week, Consolidated being reported to-day (Friday) at 143 to 144. The shaky condition of the general share list is responsible for the weakness in Consolidated, which is decidedly a purchase at the quotations. Other city gas shares are dull and strong. The progress of consolidation over in Brooklyn is referred to elsewhere in the JOURNAL, and from now on the movement will be pushed along. The capital of the Company is to be $15,000,000 in stock and an equal amount of bonds. In out-of-town shares Lacledes are better, and so is Baltimore Consolidated, while Chicago gas is weak at 62 to 62¼. The Welsbach Light Company has declared a dividend of 20 per cent., payable September 19th, to shareholders of record of the 13th inst. Cincinnati gas sold up to 204½, and as the consolidation at Newark is an accomplished fact, we may look for a quotation in the new bond issue there at any time. Consumers, of Jersey City, is being inquired after, at 92 or better, and it looks to us to be a purchase at anything under 95.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

SEPTEMBER 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	143	144
Central	500,000	50	150	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	195	..
Bonds, 6's	1,000,000	1,000	106	..
" 1st Con. 5's	2,300,000	1,000	113	115
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	173	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50	90	91
" Bonds	150,000	1,000	..	96
New York and East River	5,000,000	100	31	33½
Preferred	2,000,000	100	53½	55½
Bonds	3,500,000	1,000	92¾	93¾
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	60	..
Preferred	5,000,000	100	108½	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	100	..
Yonkers	200,650	50	112	..
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	330,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	800,000	..	108	..
Peoples	1,000,000	10	90	..
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	225	..
" Ctfs.	700,000	1,000	99	100
Williamsburgh	1,000,000	50	210	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	50	19⅛	20⅛
" Income Bonds	2,000,000	1,000	23	..
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	..	80
2d " " "	3,000,000	1,000	51	55
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	.....	..	95	..
Chicago Gas Co.	25,000,000	100	62	62⅛
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	93	93½
Columbus	1,000,000	..	63	66
1st Mortgage	1,085,000	..	91	93
Consumers, Jersey City	2,000,000	100	91	93
" Bonds	600,000	1,000	100	105
Cincinnati G. & C. Co.	7,000,000	100	203½	204
Consumers, Toronto	1,600,000	50	184⅛	187
Capital, Sacramento	.....	.	..	41
Consolidated, Baltimore	11,000,000	100	..	63½
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	30¾	..
" Con. Bonds	4,312,000	..	75	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	72	74
" Bonds	2,000,000	..	85	..
Hartford	750,000	25	130	135
Indianapolis	2,000,000	..	150	155
" Bonds, 6's	2,650,000	..	105⅛	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	86
Bonds	1,000,000	1,000	88	90
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	27½	28
Preferred	2,500,000	100	85	87
Bonds	9,034,400	1,000	97	97¼
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	..
New Haven	.....	25	225	..
Oakland, Cal.	.....	..	45	..
Peoples Gas Lt. & Coke Co.,				

DIVIDEND NOTICE.

OFFICE OF WELSBACH LIGHT CO.,
DREXEL BUILDING, PHILA., Sept. 11, 1895.

The Directors have this day declared a dividend of twenty (20) per cent., payable on Sept. 19, 1895, to stockholders of record at the close of business Sept. 13. Checks will be mailed.

1058-1 EDWARD C. LEE, Treasurer.

WANTED,

A Man to Take Charge of a Quite Small Coal Gas Works,

Located in Wisconsin. Salary would be small, but with chance of promotion.

1058-2 Address "A. C. G.," care this Journal.

POSITION WANTED

As Supt. or Manager of a Gas Works or Gas and Electric Light Works.

Fifteen years' experience as Manager of Gas Works and six years Gas and Electric Light Works. Good reasons for wishing to change present employment.

1043-tf Address "Y. B.," care this Journal.

GAS WORKS FOR SALE AT AUCTION.

The Gas Works at Huntington, N. Y., recently completed and put in operation, will be sold at foreclosure sale, at that place, at the Works, at 12 M., Sept. 17, next. The Works are entirely new, are installed under the Lowe system, and have cost nearly $80,000. (See JOURNAL of Jan. 21, 1895.) For particulars inquire of INMAN BROTHERS COMPANY,
136 Liberty Street, N. Y. City.

Get Our Prices on

Mica Chimeys

For Welsbach Lights,

AND ON

Mica Canopies.

The MICA MFG. CO.,

Micasmiths,

88 Fulton Street, - - New York City.

THE HAZELTON OR PORCUPINE WATER TUBE BOILER.

The Best Boiler in the World, and the Cheapest per Square Foot of Heating Surface.

Unequaled for the Economical Production of Very Dry Steam.

WE GIVE Liberal Capacity, Highest Efficiency, Absolute Safety and Thorough Workmanship.

WE SOLICIT the Critical Examination of the Mechanical Profession and the Steam-Using Public, and Your Trade.

Send for Catalogue and Reports of Tests.

The HAZELTON BOILER COMPANY,

Sole Proprietors and Manufacturers,

Cable Address, "Paila," New York.
Tele., "1229-18th St.," New York.

Gen'l Office, 716 E. 13th St., N.Y., U.S.A.

GREENFIELD

Steam Engine Works.

Established 1874.

MANUFACTURERS OF

Greenfield Stationary, Portable and Yacht

ENGINES AND BOILERS.

Also Horizontal, Automatic and Variable Cut-off Engines.

Sizes from 3 to 75 Horse Power.

Also Vertical and Horizontal and Marine Boilers.
Steam Pumps and Adams' Grate Bars.

W. G. & G. GREENFIELD, - - EAST NEWARK, N. J.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

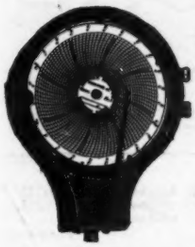
Ammonia Concentrator.

Not Expensive. Write to STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich

BRISTOL'S RECORDING PRESSURE GAUGE

For Continuous Records of

Street Gas Pressure.



Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

THE BRISTOL CO.
Waterbury, Conn.

Received Medal at World's Columbian Exposition.

Special Trays for Iron Sponge or Oxide of Iron.

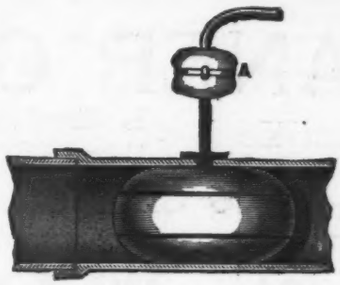
CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired

306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET
Send for Circulars.

Peerless Patent Improved Gas Bag



These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficienty inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

3-in.	Gas Bag,	each,	$0.60	12-in.	Gas Bag,	each,	$5.00
4 "	"	"	.80	16 "	"	"	8.25
5 "	"	"	1.05	20 "	"	"	12.00
6 "	"	"	1.75	24 "	"	"	17.00
8 "	"	"	2.65	30 "	"	"	27.50
10 "	"	"	3.75				

The Peerless Rubber Mfg. Co.
16 Warren St, N. Y. City.

Patent Lava Gas Tips.

UNIFORMITY GUARANTEED.
ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

MOSES G. WILDER,
Mechanical Engineer,
816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors,
Governor Gas Burners,
Gas Cocks and Fittings,

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters.* The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

BRAY'S PATENT "ENAMELED" GAS BURNERS.

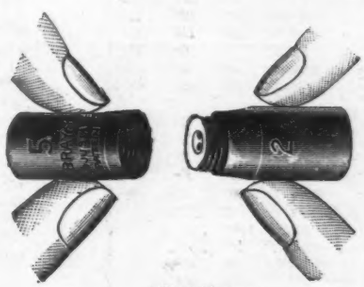
Bray's "Special" and "Adjustable" Burners

Are the Cheapest, Most Economical and Most Durable in existence, and will, at their REDUCED PRICE, save their cost in gas alone in forty hours' use.

Union Jet.

Slit Union.

Batswing.


Adjustable.

Made with Inside Screw to Suit American Fittings.

The "Specials" are made to Suit Low and High Pressures. The "Adjustables" consist of two Burners screwed together, the size of which can be arranged to suit any Pressure and Consumption. For full description see Catalogue.

See that **"Bray's Special"** or **"Bray's Adjustable"** is stamped on each kind of Burner.

ACETYLENE AND RICH OIL GASES.—We now make Burners suitable for use with these Gases.

TO BE HAD OF FACTORS THROUGHOUT THE STATES.

WANTED,

By a man who has had a round experience in the manufacture and sale of gas,

A Position as Supt. of a Large or Small Gas Works.

Is capable and energetic, and is willing to begin at a moderate salary. Address

1032-tf "B.," care this Journal.

If You Want the Best GAS-TIGHT Tubing,

BUY OF THE

NEW YORK GAS TUBING CO.

334 & 336 East 23d St., N. Y.

GUARANTEED NOT TO STIFFEN. Makers of All Kinds of Flexible Tubing.

The Celebrated **SHANER GAS COAL**

CORRESPONDENCE SOLICITED.

Is Mined and Shipped from the Best Gas Coal Basin in Pennsylvania.

SHANER COAL CO., - 1326 Chestnut Street, Philadelphia.

THOS. N. MORDUE,

Cannel Coal Merchant,

No. 1 Broadway, - - - New York City.

Exclusive Shipper of the following celebrated

GENUINE KENTUCKY CANNELS.

BRECKENRIDGE. The richest Cannel in the world; will yield 15,200 cubic feet of 46.20 candle gas per ton of Cannel.

O. K. BOGHEAD. Will yield 16,504 cubic feet of 38.15 candle gas per ton of Cannel.

BIRDSEYE. Will yield 14,132 cubic feet of 36.55 candle gas per ton of Cannel.

ALL PRODUCE EXCELLENT COKE.

Shipments in sealed box cars direct from the mines to any required station in the United States or Canada. Cargo Shipments from Newport News or Norfolk, Va. *Correspondence Solicited.*

The WOLFF Gas Radiator.

Size, 33 Inches High, 21 Inches Wide and 10 Inches Deep. The Trilby Heaters are furnished in Brass, Copper-Bronze and Nickel Plate.

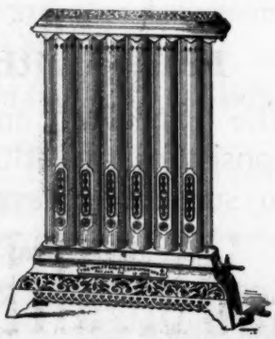
The Most Ornamental and Economical Gas Heater in the World.

The WOLFF Gas Radiators are no Longer an Experiment.

Heating with gas as a fuel instead of wood or coal was made practicable only four years ago, when the first WOLFF Gas Radiator was made. Since that time we have supplied Gas Radiators to heat all kinds of Rooms, Halls, Stores, Churches, Theaters, etc.; they are used in Bed Chambers, Sick Rooms, and wherever heat is required. And, because of their great success, several imitation Gas Radiators are offered, "said to be as good as Wolff's;" but none of them are as good. The WOLFF Radiator gives more and better quality of heat, at less cost, than any gas heater in the market.

In our Trilby Heater we again offer something **new, novel** and **good,** as well as beautiful and pleasing to the eye. Most Stoves, Heaters and Radiators in use heat the **top** of the room, leaving the **floor** cold (hence keep the head warm and the feet cold). Our Trilby Heater warms the floor first; then the heat rises gradually, warming the whole room comfortably, cold air being drawn in from the bottom (passing between the heated radiating flues) and thoroughly warmed before passing out at the top, while the gas, mixed with air, is burned in our "Patent Incandescent Iron Fires Burners," which greatly intensifies the heat, causing an extra amount of heat to be radiated, or thrown off onto the floor, while the products of combustion are carried up through radiating iron flues to the top of the Trilby Heater, and downwards and out through opening to flue or chimney pipe connection, making a current or outlet for burnt gas or impure air, thus causing perfect ventilation in the room.

The Trilby uses less gas and gives more and better heat than any other Gas Radiator in the market.



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THE WOLFF GAS RADIATOR MANUFACTURING CO.,

Office, 164 Franklin St., New York.

These are the Handsomest, Best Finished and Most Powerful Gas Heaters in the World. They give the greatest amount of Heat for the quantity of Gas consumed, therefore being the most economical Gas Heaters to use.

FIRE KING GAS RADIATORS

These Gas Radiators are no experiment. They were brought out last Season and an immense number sold, and every one gave perfect satisfaction. This Season they are better than ever and right up to date in every respect. THEY ARE NOT OLD-TIME GOODS.

THE BEST IN THE WORLD.

Made with 4, 6, 8 and 12 Tubes, and finished in either Nickel or Bronze.

We also have something new in the way of a Square Gas Heater, which is the handsomest Stove of the kind on the market. Send us an order for Samples and be convinced that the "FIRE KINGS" lead all others. Have you got our New Catalogue? If not, write for one at once.

The Patent Lighter Cocks used on these Radiators, which have also been improved for this Season, are the finest Cocks ever put on a Gas Stove. We manufacture all these Cocks ourselves out of the best Brass and by skilled labor, and they are not like the common Cocks now used on Gas Stoves, and bought from the man who makes them the cheapest.

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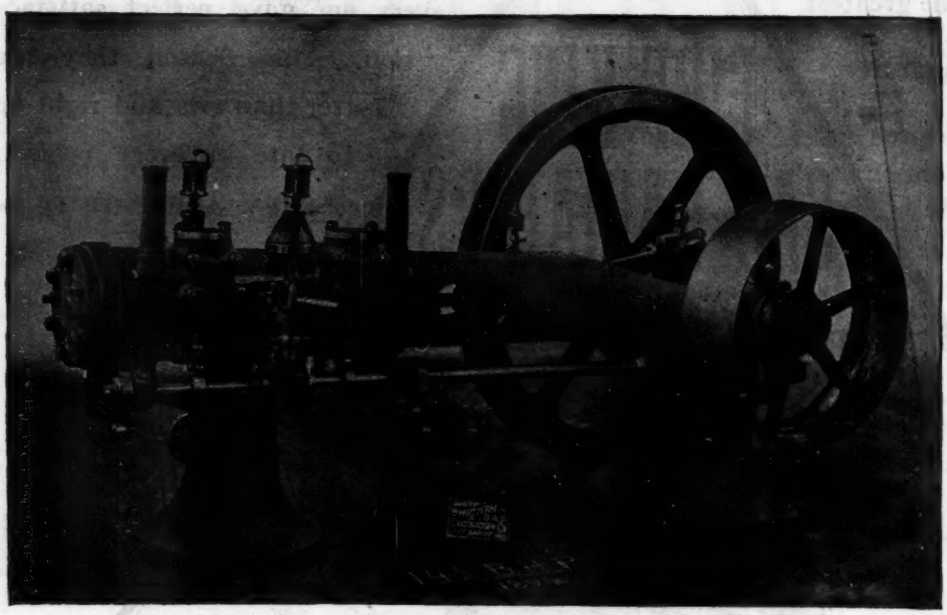

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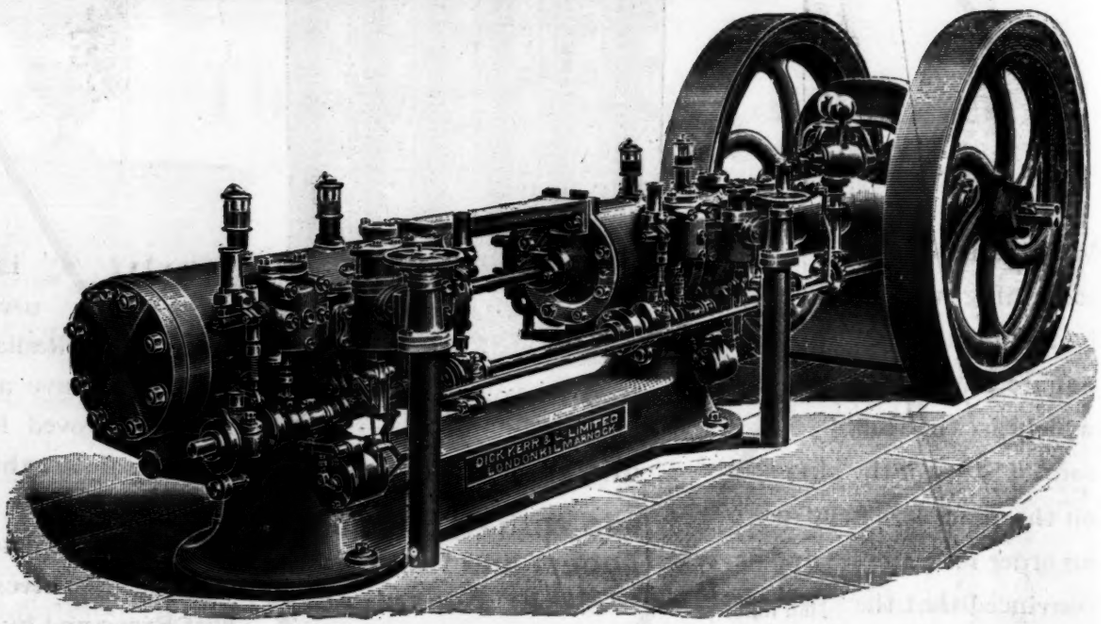

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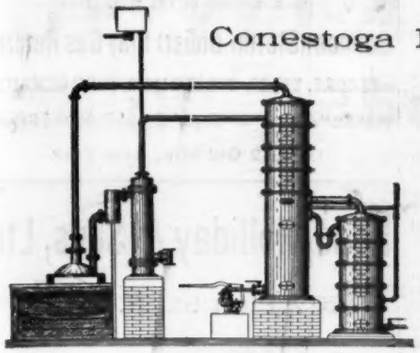

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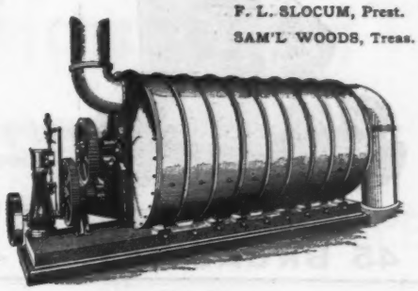

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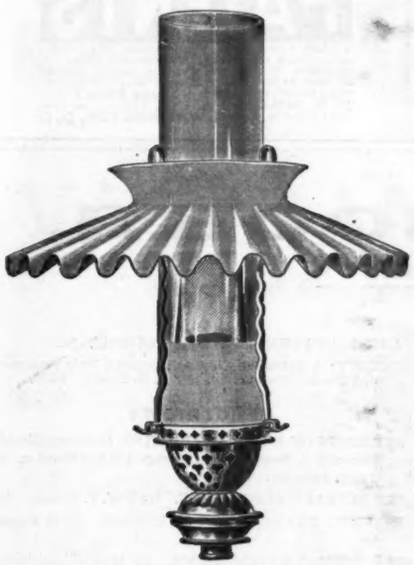

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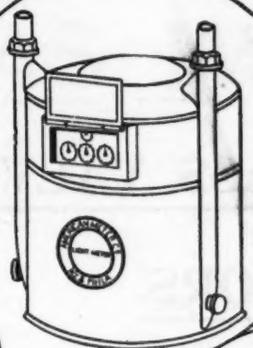
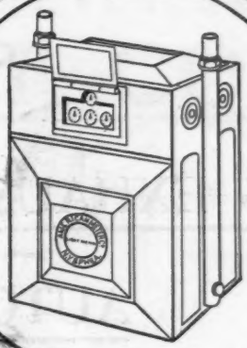
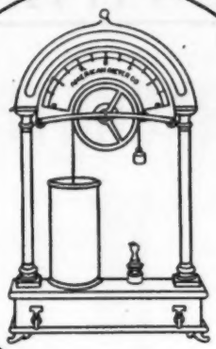
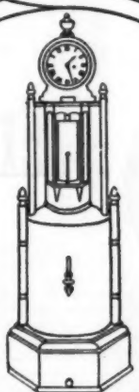




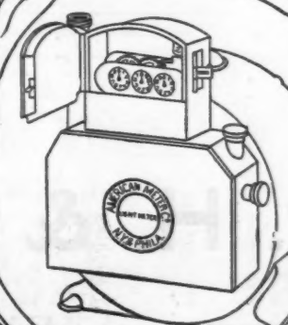


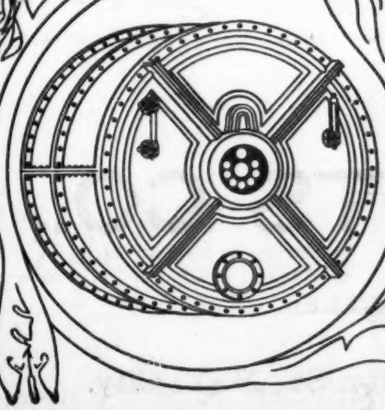


PUBLIC LIGHTING TABLE.

OCTOBER, 1895.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	3.40 AM	5.00 AM	5.30	5.00
Wed.	2	No L.	No L.	5.30	5.00
Thu.	3	No L. FM	No L.	5.30	5.00
Fri.	4	No L.	No L.	5.30	5.00
Sat.	5	6 00 PM	7.10 PM	5.30	5.00
Sun.	6	6.00	7.40	5.30	5.00
Mon.	7	6.00	8.10	5.30	5.00
Tue.	8	6.00	8 50	5.20	5.10
Wed.	9	6.00	9.50	5.20	5.10
Thu.	10	6.00	10.50	5.20	5.10
Fri.	11	6.00 LQ	12.00 AM	5.20	5.10
Sat.	12	6.00	1.20	5.20	5.10
Sun.	13	5.50	2.30	5.20	5.10
Mon.	14	5.50	5.10	5.20	5.10
Tue.	15	5.50	5.10	5.10	5.20
Wed.	16	5.50	5.10	5.10	5.20
Thu.	17	5.50 NM	5.10	5.10	5.20
Fri.	18	5.50	5.10	5.10	5.20
Sat.	19	5.50	5.10	5.10	5.20
Sun.	20	5.40	5.20	5.10	5.20
Mon.	21	5.40	5.20	5.10	5.20
Tue.	22	7.10	5.20	5.00	5.30
Wed.	23	8.20	5.20	5.00	5.30
Thu.	24	9.20	5.20	5.00	5.30
Fri.	25	10.20 FQ	5.20	5.00	5.30
Sat.	26	11.30	5.20	5.00	5.30
Sun.	27	12.30 AM	5.30	5.00	5.30
Mon.	28	1.30	5.30	5.00	5.30
Tue.	29	2.30	5.30	4.45	5.35
Wed.	30	3.30	5.30	4.45	5.35
Thu.	31	4.30	5.30	4.45	5.35





TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

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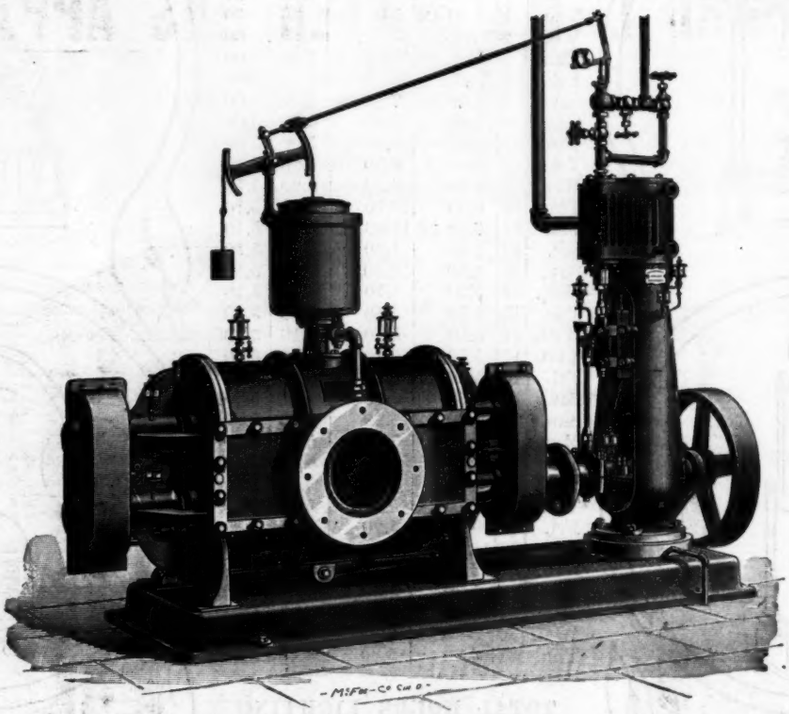

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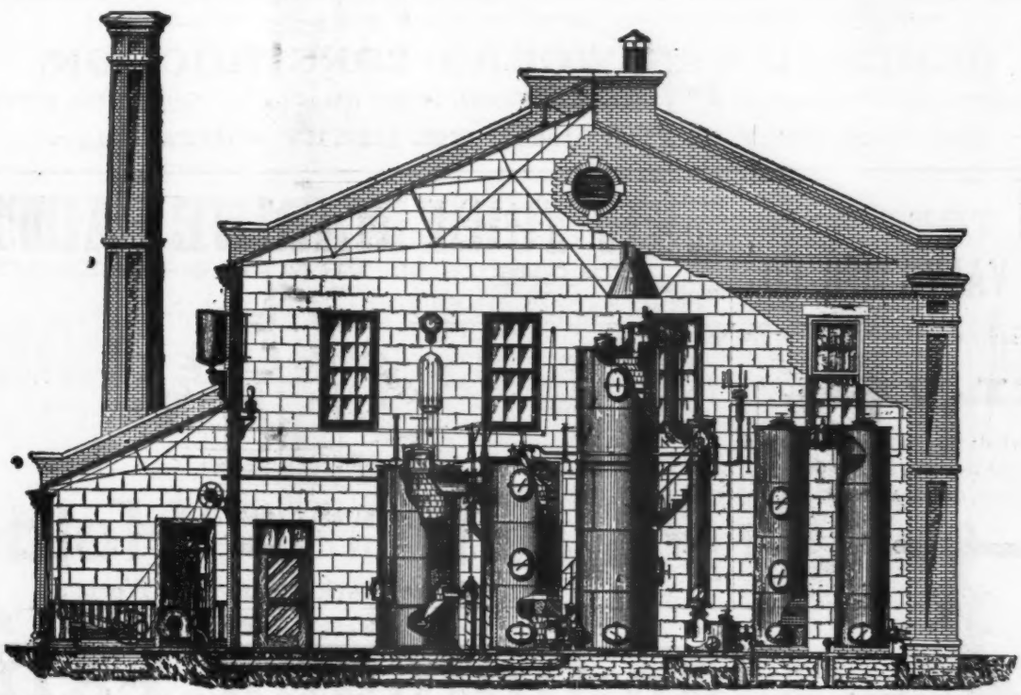

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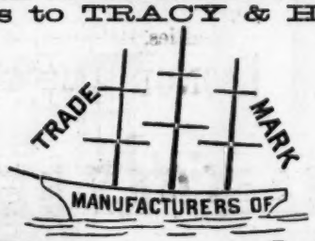

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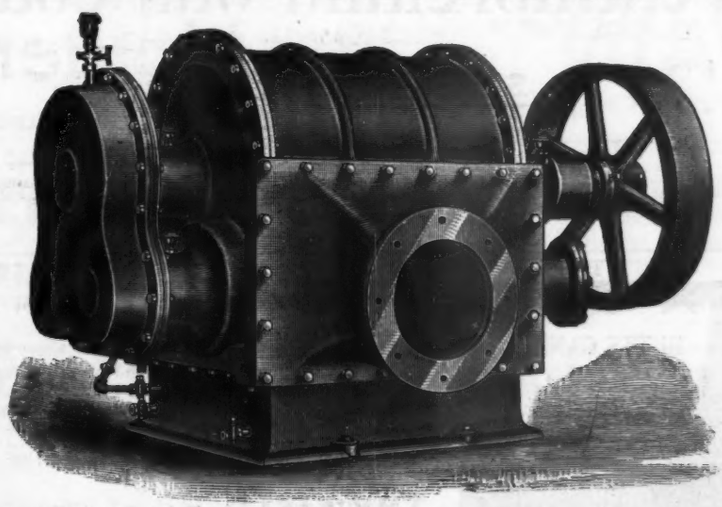

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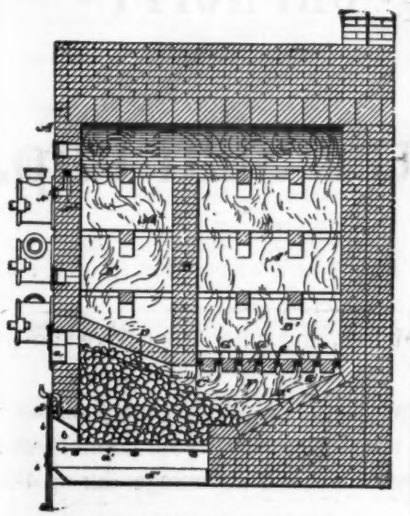

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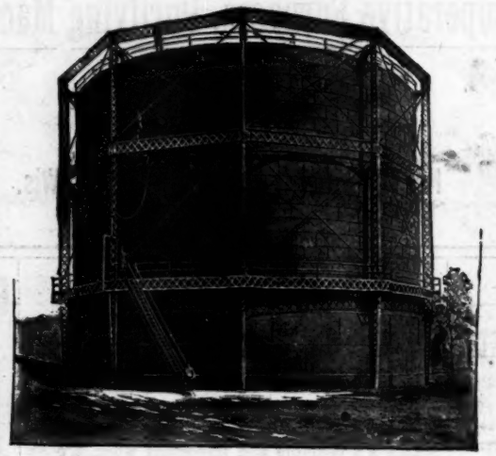

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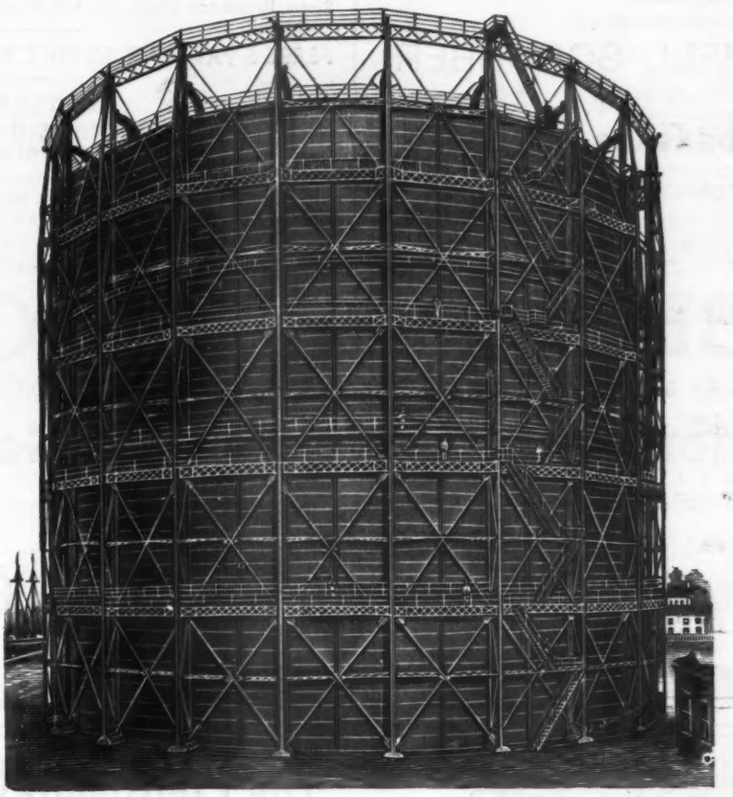

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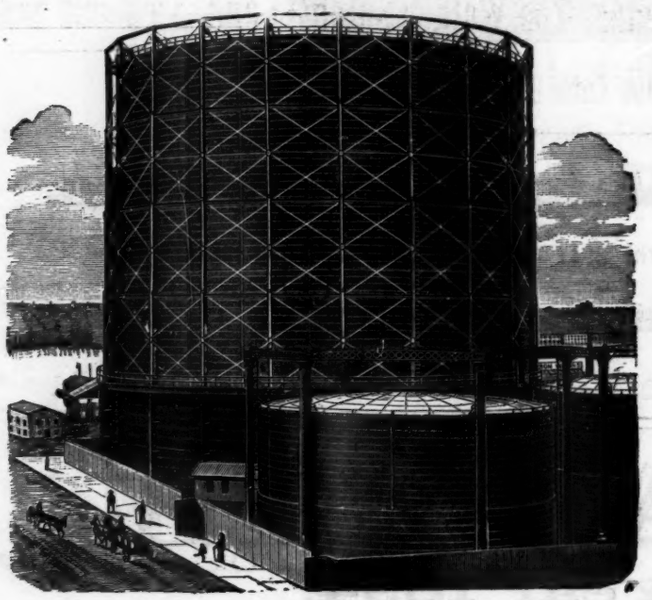

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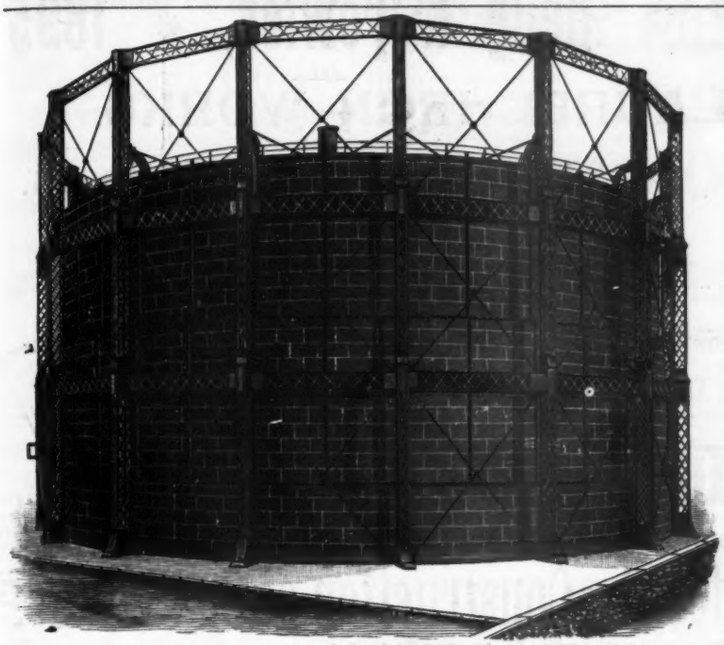

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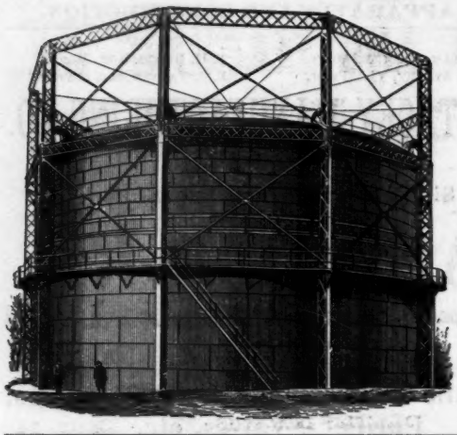

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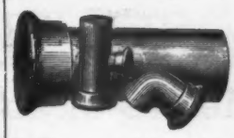
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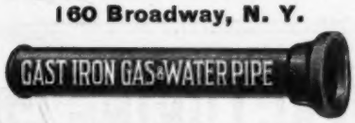

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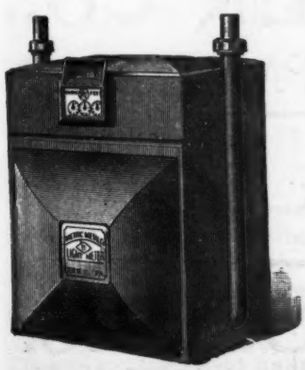

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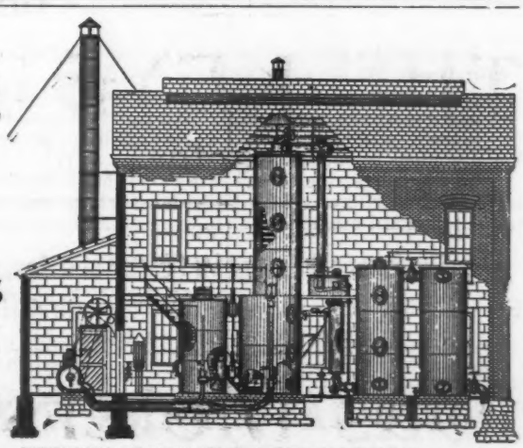

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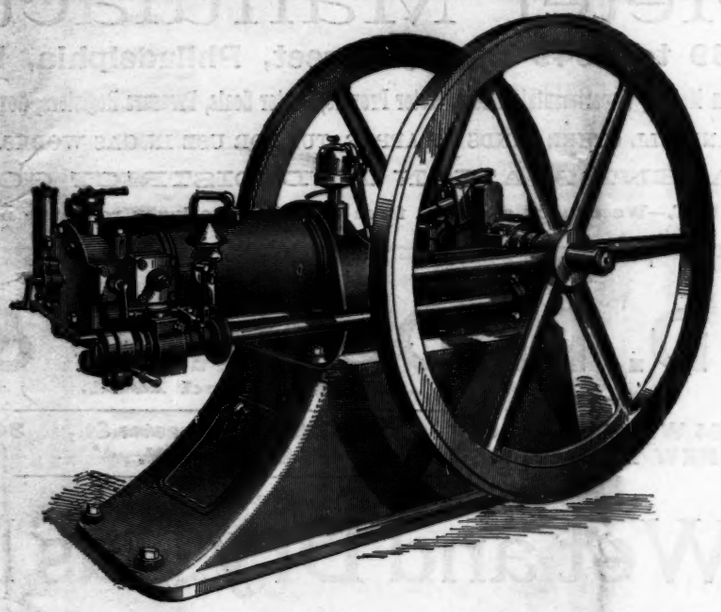

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